Report of the
Defense Science Board
Task Force on

Nuclear Deterrence Skills

September 2008

Office of the Under Secretary of Defense
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The DSB is a Federal Advisory Committee established to provide independent advice to the Secretary of Defense. Statements, opinions, conclusions and recommendations in this report do not necessarily represent the official position of the Department of Defense.

The DSB Task Force on Nuclear Deterrence Skills
completed its information gathering in May 2008.

This report is unclassified.

OFFICE OF THE SECRETARY OF DEFENSE
3140 DEFENSE PENTAGON
WASHINGTON, DC 20301-3140

DEFENSE SCIENCE
BOARD

11 September 2008

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY & LOGISTICS

SUBJECT: Final Report of the Defense Science Board (DSB) Task Force on Nuclear Deterrence Skills

I am pleased to forward the final report of the DSB Task Force on Nuclear Deterrence Skills, chaired by ADM Henry "Hank" Chiles.

As requested in the Terms of Reference the Task Force was asked to assess all aspects of nuclear deterrent skills (military, federal, and contractor.) Specifically, utilize the 2000 Nuclear Posture Review and the Strategic Capabilities Assessment to frame the operation of: a) nuclear project management, b) nuclear safety and security, c) weapons effects, simulators, EMP and survivability, d) design and logistics, e) C2, nuclear operations (crew training) and execution, f) planning and g) nuclear policy; assess the progress of the Department of Energy since the publication of the Chiles Commission report; and recommend methods and strategies to maintain a right-sized U.S nuclear deterrent through 2020.

The final report provides findings and recommendations addressing broader programmatic issues stemming from a lack of prioritization and de-emphasis of nuclear related systems. The senior leadership must become more involved in developing and sustaining the role of nuclear forces in the 21st Century. Once defined and agreed upon, it can then be used to strategically manage nuclear competencies (design, industry, assessment skills) and capabilities.

I endorse the Task Force's findings and recommend the implementation of its recommendations across the Nuclear Enterprise.

William Schneider, Jr.

Dr. William Schneider, Jr.
Chairman
Defense Science Board

OFFICE OF THE SECRETARY OF DEFENSE
3140 DEFENSE PENTAGON
WASHINGTON, DC 20301-3140

DEFENSE SCIENCE
BOARD

30 June 2008

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Report of the Defense Science Board (DSB) Task Force on Nuclear Deterrence Skills

The final report of the DSB Task Force on Nuclear Deterrence is hereby forwarded.

This report recommends methods and strategies that the Secretary of Defense, Commander of U. S. Strategic Command, military services, Administrator of the National Nuclear Security Administration, the Director of National Intelligence, and other senior officials should take to maintain a right-sized, properly trained, and experienced work force to ensure the viability of the U.S. nuclear deterrent through 2020.

We have assessed all aspects of nuclear deterrent skills—military, federal, and contractors—across a number of "stovepipes" as part of a common nuclear security enterprise. We used the 2002 Nuclear Posture Review (NPR) and the Strategic Capabilities Assessment which followed the NPR to frame the operating environment of this assessment. Additionally, we assessed the progress the Department of Energy has made since the publication of the Commission on Maintaining United States Nuclear Weapons Expertise in 1999.

Our findings are based on significant data collection and extensive discussions with the leaders and members of the nuclear security enterprise. In addition to visits to many of the major activities supporting nuclear deterrence, we also surveyed the key attitudes and work force issues of over 8,000 members of this community.

The report provides specific recommendations in the following areas:

1. Senior leaders must develop a clear vision and strategy for nuclear deterrence capabilities and competencies, reinforce the necessity for and value to the nation of nuclear deterrence, restore the rigor and focus necessary to reestablish the proficiency for nuclear operations and reduce the high indirect cost of the nuclear weapons complex.

2. OSD should be reorganized to elevate nuclear weapons-related responsibilities to ensure appropriate attention is focused on development of national nuclear weapons strategy and to assure

deterrence posture of the United States are provided appropriate evaluation.

3. From a strategic planning perspective, nuclear capability and competence requirements should be established using the next Nuclear Posture Review, the nuclear weapon foreign intelligence skill base should be reinforced, a broad human capital management system(s) should be developed for organizations of the nuclear security enterprise, and NNSA should make development of capabilities and competencies for design through production, integration, and stockpile surveillance an explicit part of NNSA planning.

4. Specific capability and competence in offensive and defensive aspects of nuclear operations should be developed through training, exercises, improved courses of instruction, and implementation of operational changes. Advanced technical work is needed to reestablish or maintain proficiency on a broad scale.

The task force is appreciative of the effort provided by knowledgeable advisors and the many personnel who helped to educate the Task Force on the current status and future nuclear deterrence needs.

The Task Force and government assistants have provided unique talents, energy and careful attention to this effort. I greatly appreciate their diligence and enthusiasm.

Warm regards,

Henry G. Chiles

Henry G. Chiles Jr.
Chairman, Task Force on Nuclear
Deterrence Skills

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Executive Summary

The Defense Science Board Task Force on Nuclear Deterrence Skills was chartered to assess all aspects of nuclear deterrent skills—military, federal, and contractor—and to recommend methods and strategies to maintain a right-sized, properly trained, and experienced work force to ensure the viability of the U.S. nuclear deterrent through 2020.

As long as anyone in the world has or can acquire nuclear weapons, America must have nuclear deterrence expertise competent to avoid strategic surprise and respond to present and future challenges. There are many kinds of threats that demand national leadership, but no threat can put the nation's existence at risk as quickly and as chillingly as nuclear weapons. To say this is not to dismiss the seriousness of other threats. It simply acknowledges that since the dawn of the nuclear age, security from nuclear attack has been in a class of its own, and major national decisions on nuclear deterrence issues have been reserved for the President of the United States.

Nuclear deterrence expertise is uniquely demanding. It cannot be acquired overnight or on the fly. It resides in a highly classified environment mandated by law, it crosses a number of disciplines and skills, and it involves implicit as well as explicit knowledge. Nuclear weapons expertise is necessary to design and build nuclear weapons, to plan and operate nuclear forces, and to design defense against nuclear attack. It is also necessary to analyze and understand foreign nuclear weapons programs, devise nuclear policies and strategies, deal with allies who depend on the American nuclear umbrella, prevent and counter nuclear proliferation, defeat nuclear terrorism, and—in the event that a nuclear detonation takes place by accident or cold, hostile intent—cope with the catastrophic consequences.

America's nuclear deterrence and nuclear weapons expertise resides in what this study calls the "nuclear security enterprise." This enterprise includes nuclear activities in the Department of Defense (DOD), Department of Energy, Intelligence Community (IC), and the Department of Homeland Security.

During the Cold War, the bulk of the nuclear security enterprise consisted of the U.S. nuclear weapons program and force posture devoted to deterring the Soviet Union. The skills acquired for those activities provided a robust base from which the United States not only could conduct nuclear deterrence, but also

could devote expertise with nuclear proliferation and nuclear terrorism issues. However, nuclear deterrence was the principal focus.

Today, deterrence of major power nuclear threats and the prospects of global war have receded in national priority while nuclear proliferation terrorism and defense have become urgent concerns. Today's nuclear security enterprise devotes the energy and attention to proliferation and terrorism issues that once were reserved for nuclear offensive forces. It is in that context that this task force reviewed nuclear deterrence expertise.

Principal Observations

The task force is concerned that adequate nuclear deterrence competency will not be sustained to meet future challenges. A national strategy for the nuclear security enterprise has not been emphasized and, as a consequence, there is disillusionment within the workforce that could lead to decline in the remaining critical skills. Existing and emerging weapons of mass destruction (WMD) threats and adversary intentions are not well understood. Intelligence assessments lack the needed focus and expertise.

The perception exists that there is no national commitment to a robust nuclear deterrent. This is reflected in the downgrading of activities within Office of the Secretary of Defense (OSD) policy and the Joint Staff, U.S. Strategic Command (STRATCOM), the U.S. Air Force, and congressional action on the Reliable Replacement Warhead (RRW).

Management and the work force in the defense industry and in nuclear weapon contractors believe that "sustainment" programs (*e.g.* life extension programs) will not retain the skills necessary to competently solve major problems with existing systems or to initiate new programs should the need arise. Pessimism exists about follow-on nuclear deterrence systems becoming a reality, thereby leading to loss of opportunity to train the next generation of nuclear weapon system experts. Priorities have shifted strongly, and to a degree appropriately, but the pendulum has swung too far. Now the nation is faced with about $100 billion of decisions (RRW, Complex Transformation, land-based strategic deterrent, sea-based strategic deterrent), with an eroded capability to think about these issues and with attention focused on other priorities.

Findings

In the absence of a strong national commitment to sustaining the nuclear security enterprise and visible leadership starting at the senior levels, it is difficult to keep the rigor and focus needed at all levels to meet the demanding proficiency standards that are indispensable for nuclear deterrence activities. It also is difficult, absent such a strong national commitment, to retain the best of the younger workforce. Words are not enough. There must be evidence of commitment that manifests itself in both strong leadership *and* real, meaningful work.

Today's nuclear weapons expertise generally is of high quality, although we are unable to assess the capability to design, develop, and produce new weapons or weapon systems through the entire cycle, as the nation has not done so for over 15 years. The challenge for the future is to preserve nuclear weapons expertise across the entire spectrum of requirements ranging from today's priorities to a possible return, best intentions and efforts notwithstanding, of international relations dominated by major power nuclear confrontation.

The task force is concerned about the future of America's nuclear deterrence expertise. A significant part of the current workforce in the national laboratories and production facilities are at or nearing retirement age. New people must be hired and trained. This need is complicated by resource issues in today's environment. More fundamentally, however, the task force does not find adequate planning for dealing with the problem. The situation is further affected by the general decline in the numbers of U.S. citizens acquiring graduate degrees in science and engineering. Citizenship remains a prominent requirement in the highly classified world of nuclear weapons work. With our current course the end state will not provide for a safe and reliable stockpile or for a responsive infrastructure.

The technical expertise required for dealing with the nuclear dimensions of proliferation, terrorism, and defense is closely related to nuclear weapons skills. Indeed, a significant part of the intellectual capital derives from expertise and knowledge acquired by working with nuclear weapons and related technologies. The nuclear experts drawn from the weapons program are needed in counter proliferation and counterterrorism.

The problems the task force identified are not insurmountable. The United States retains the capacity to step up to the most difficult challenges, given commitment and leadership. Sustaining nuclear weapons expertise is such a challenge.

Recommendations

Based on these and other related findings discussed in this report, the task force has arrived at twenty-three major recommendations, categorized as dealing principally with: leadership, organization, strategic planning, and capabilities and competencies.

Leadership

1. The Secretary of Defense, working with the Secretaries of State, Energy, and Homeland Security, and the Director of National Intelligence, must lead the development of a clear U.S. vision and strategy for nuclear deterrence capabilities and competencies.

A new vision is required of what comprises needed nuclear deterrence capabilities and competencies, and how to sustain them. The strategy should address 21st century nuclear deterrence capabilities needed to respond to an uncertain future while supporting the broadly held goal of reduced reliance on nuclear weapons. Advocacy within the government requires a comprehensive framework and a widely shared and understood set of concepts for dealing with the national security issues raised by nuclear weapons across the board—American nuclear weapons and their role in deterrence, nuclear weapons and materials in the hands of states, nuclear terrorism, nuclear proliferation, and global/regional nuclear threat reduction.

2. Senior civilian and military leaders should reinforce the necessity for and value to the nation of the nuclear deterrence mission.

The administration and senior military leadership, through actions and words, should make a concerted and continuing effort to convey to the nuclear weapons community that their mission is vital to the security of the nation and will remain vital well beyond the planning horizons normally associated with programmatic decisions.

3. Commander, U.S. Strategic Command, should strengthen the headquarters supervision and involvement in the nuclear weapons program.

- The STRATCOM Commander (Gen Chilton) has initiated corrective action in this regard.

4. **Air Force and U.S. Strategic Command leadership should restore the rigor and focus necessary to reestablish and sustain the demanding proficiency necessary for nuclear operations.**

Commanders must plan, integrate, fund, train, and staff subordinate commands to ensure effective skills for mission success at all levels. Unresolved waivers of security and other requirements should have corrective action planned and funded. Nuclear bomber alert should be exercised and adequate training incorporated as necessary. Personnel Reliability Program (PRP) requirements should be reviewed to ensure realistic requirements.

5. **The Administrator of the National Nuclear Security Administration (NNSA) must reduce the high indirect cost of the nuclear weapon complex. These high costs impede refurbishment of legacy weapons, or authorization of new weapons if proposed, and preclude the work experience needed to maintain competence.**

The NNSA laboratories and production facilities must be incentivized to reduce indirect costs to make more affordable efforts to sustain and enhance the skills needed to respond to today's threats and future challenges. Many of the causes of these high indirect costs fall outside the control of the Administrator, but he can, working with the Secretary of Energy and Congress, move to address this increasingly burdensome issue.

Organization

6. **The Secretary of Defense should assure that nuclear-weapon-related responsibilities in OSD are at the proper level and are adequately staffed.**

Create an Assistant Secretary of Defense for Strategic Weapons as previously recommended by the Defense Science Board Permanent Task Force on Nuclear Weapons Surety. Elevate nuclear weapon responsibilities within the Office of the Under Secretary of Defense for Policy to the level of Deputy Under Secretary to ensure high level attention is focused on development of a national nuclear weapon strategy, and to assure that issues affecting the deterrence posture of the United States are provided appropriate evaluation. Reestablish OSD study and analytic capabilities for nuclear deterrence to support senior decision-makers.

Strategic Planning

7. The Secretary of Defense should establish nuclear requirements for capabilities, including nuclear competencies, force structure, and programs for the timeframe 2009 to 2030, using the next Nuclear Posture Review (NPR), and provide requirements for NNSA planning.

Evaluate the U.S. nuclear weapons capabilities needed as hedges against the uncertain future. Also, as part of the NPR, evaluate the technical feasibility and cost aspects of adding nuclear capability to platforms developed for conventional weapon delivery.

8. The Secretaries of Defense and Energy, with the Director of National Intelligence, should urgently identify and act to fill the gaps in the skill base needed to improve assessments of foreign nuclear programs.

Focus requirements on nuclear expertise to monitor, assess, and analyze the global threats posed by nuclear weapon developments, proliferation of nuclear technology, and potential employment of nuclear weapons or "dirty bombs" that could threaten the United States, U.S. forces abroad, or allies and friends. Leadership should challenge current assessments utilizing a peer review process (red teams) to ensure that more of the known and unknown issues are identified and corrective action assigned to competent specialists for resolution.

9. The Assistant Secretary of Defense for Strategic Weapons (when appointed) and Administrator, NNSA, must maintain critical weapon design, development, production, integration, and surveillance skills by exploring follow-on nuclear weapon system designs, including prototyping (even without commitment to production).

Development of new systems (of any kind) requires certain skills that are different from those needed to sustain existing systems. A program of exploration of follow-on nuclear weapon and weapon system design should be re-established at some level that is decided by balancing the real risks. With regard to future life extension programs, dual revalidation of nuclear weapon refurbishments should be required not only to ensure the weapons remain safe, secure, and reliable, but also to improve the workforce expertise.

The full range of real and engaging work is the only validated mechanism for sustainment of unique skills. Some provision must be made for skills not used today but possibly needed quickly in the future. Sustainment and dismantlement programs cannot be relied upon to exercise and maintain the total competencies

required. DOD and NNSA must work with the Congress to ensure an annual workload that is reasonably stable yet can accommodate design, development, and production rate changes and avoid interruptions that compromise long-term mission design and production competence. The production rate must provide the basis for surge should it be necessary.

10. **The Administrator, NNSA, should make the development of capabilities and competencies an explicit part of NNSA planning consistent with the next NPR.**

The Administrator should establish and implement a strategy and plans on a priority basis for the next generation of nuclear stewards, identify and implement strategies and tools for recruiting and retaining essential weapons employees, and adopt a comprehensive strategy for knowledge transfer and training that emphasizes the essential contribution of hands-on work.

11. **Cognizant organizations throughout the nuclear enterprise—within government and the supporting contractor base—should maintain selected nuclear skills by managing their application in related non-nuclear applications where appropriate.**

    - Careful coordination of requirements to describe the minimum set of capabilities needed and thoughtful cost allocation are required to fully leverage activities that are technically similar to nuclear work.

12. **Cognizant organizations that comprise the nuclear security enterprise (to include NNSA/DOD/IC/DNDO [Domestic Nuclear Detection Office]) should develop a human capital management system(s) to identify current and future needed capabilities and manage so personnel can move from one part of the nuclear security enterprise to another as needed.**

Capabilities and Competencies

13. **The Secretary of Defense should require the periodic participation of senior civilian and military leadership in exercises that involve the use of adversary and/or U.S. nuclear forces.**

    - Training these senior leaders in nuclear weapon-related scenarios is important for competent decision-making.

14. The Secretary of Defense should establish Department of Defense requirements for understanding foreign cultural and behavioral factors related to nuclear issues.

Potential adversaries generally do not have the same views of their nuclear weapons future as the United States. Deterring future adversaries will require greater understanding of the goals, culture, values, social characteristics, government limitations, leadership decision-making, and motivations of nations and non-state actors. Such an understanding is an essential component of intelligence needed for competent conduct of U.S. foreign policy. Better training and education are needed for personnel at all levels to include senior personnel and those charged with developing U.S. assurance, dissuasion, and deterrence positions, pronouncements, and use of "red lines."[1] The over-all connection between communications and deterrence requires improvement and greater use of red-team activities to improve executive decision-making. The Secretary of Defense should urge the President to take similar steps government-wide.

15. The Secretary of Defense should direct a review of war college core courses of instructions for nuclear strategy and operations to strengthen the preparation of senior military officers for future responsibilities.

- If nuclear weapons are used against, or employed by, the United States, senior personnel need to understand the ramifications and basic requirements.

16. Commander, U.S. Strategic Command, should review errors made in recent years by the operating forces and examine implementation of requirements for command and control of nuclear weapons to determine if more effective procedures can be devised.

17. Commander, U.S. Strategic Command, should review with the Director of National Intelligence and strengthen reconnaissance planning for the nuclear dimension of the global strike mission.

18. Commander, U.S. Strategic Command, should strengthen competence to identify consequences of targeting actions (battle damage assessments).

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1. A "red line" in this report is a boundary that, if crossed, will trigger punitive action against the offender.

19. **The Secretary of the Air Force and Secretary of the Navy should fund advanced development programs to technically evaluate potential replacement systems to maintain and renew necessary skills in anticipation of the end-of-life of U.S. nuclear-capable delivery systems.**

    - In particular, the task force strongly believes an advanced development program for ICBM application is needed to evaluate concepts that might be applied to any follow-on to Minuteman III. Secretary of the Air Force should review the nuclear weapons systems and weapons effects capabilities and expertise to determine if re-establishment of the Air Force Weapons Laboratory or other options is needed.

20. **The Assistant Secretary of Defense for Strategic Weapons (when appointed) and Director, Defense Threat Reduction Agency (DTRA) should rebuild the capabilities to define and update the range of nuclear threat environments that U.S. forces may face in deployed operations and in the homeland.**

21. **The Chairman of the Joint Chiefs of Staff and service chiefs should require that the competencies of military forces operating in nuclear environments be rebuilt.**

The Chairman and service chiefs should direct that joint education, training, and exercises include aspects of such operations. The Secretary of Defense should assign DTRA responsibility for technical support to exercising, gaming, education, and system/network response assessments related to nuclear survivability.

22. **Service chiefs; Director, DTRA; and Administrator, NNSA, should grow a new technical design and development skills base for the nuclear weapons effects enterprise.**

Identify skills base essential to sustain the current systems and to design, develop, and operate replacement systems. Rebuilding this capability should entail modeling and simulation capability analogous to that for weapon design. A minimum "national" nuclear weapons effects simulator enterprise should be defined to maintain the unique expertise necessary to operate ranges and test facilities. An exchange program should be implemented between DOD, Department of Energy (DOE), and NNSA laboratories to ensure remaining talent stays in the field. This community should be charged with teaching operations, system design, code development, simulator advancement, and hardening innovations. A long-term plan for growing and maintaining talent

should be developed that is connected with a sustained research and development program in all agencies to ensure a career path for professionals.

23. Congressional oversight of the nuclear weapons program should be reinvigorated.

Historically, the Congress took a major role in overseeing and supporting the nuclear weapons program. Focused and structured oversight is important today to strengthen the program, as well as the public's perception that the program is indeed a matter of supreme national interest. Focused and structured oversight should also provide the basis for the Congress to establish a multi-year fiscal commitment to the program. This would provide essential fiscal stability and assurances to those personnel working on the scientific and technical challenges of the long-term support of their missions. Finally, the Congress needs to provide positive, explicit reinforcement of the public service character of the mission to maintain a safe and reliable nuclear deterrent.

Chapter 1. Introduction

The Defense Science Board Task Force on Nuclear Deterrence Skills was chartered to assess all aspects of nuclear deterrent skills—military, federal, and contractor—and to recommend methods and strategies to maintain a right-sized, properly trained, and experienced work force to ensure the viability of the U.S. nuclear deterrent through 2020.

America's nuclear deterrence and nuclear weapons expertise resides in what the task force terms the "nuclear security enterprise." This enterprise includes not only those nuclear activities in the Departments of Defense and Energy, but also in the Intelligence Community and the Department of Homeland Security (DHS). All activities within the enterprise need to be driven by and connected to strategy, policy, and assessment of future threats. The nuclear weapon system programs historically and to a great extent still train and support the majority of experts available to work on the emerging challenges of proliferation and terrorism. In today's environment of reduced work forces and minimal systems development activities, some skills are only being sustained by work "one-step-removed" from actual nuclear efforts. Understanding the interconnections and relationships across this enterprise, depicted in Figure 1, is an important step towards developing capable and sustainable nuclear deterrent skills for the future. Our approach was intended to further this understanding.

The changing political and threat environments have and will continue to challenge the nuclear skills needed for the future. Increasingly, nuclear skills to support non-proliferation, intelligence, countering nuclear terrorism, and response to use of nuclear weapons—both on the battlefield or domestically—are at the center of ensuring the nation's security. To date, these fields have been largely managed independently from the nuclear weapons programs, though they draw on many of the same core knowledge and skill sets. Figure 1 depicts the nuclear skills community and functions.

Figure 1. Nuclear Security Enterprise

Prior Applicable Studies

In the last ten years, two significant Defense Science Board (DSB) studies were conducted in the last ten years on nuclear deterrence including expertise within DOD that apply to the current study: the October 1998 *Defense Science Board Task Force on Nuclear Deterrence* (referred to as 1998 DSB Task Force) and the March 2006 *Defense Science Board Task Force on Future Strategic Strike Skills* (referred to as 2006 DSB Task Force). Neither was cited in the Terms of Reference for this study as a specific benchmark. The current status of applicable, abbreviated recommendations for each study is provided in Tables 1 and 2.

At the request of the Congress, a detailed analysis of DOE nuclear weapons expertise was conducted in the 1998–1999 timeframe. The results—in the *Report of the Commission on Maintaining United States Nuclear Weapons Expertise*, March 1999—provides the reference point for this (2007/2008) assessment of DOE nuclear weapons expertise. The abbreviated recommendations of the report are highlighted in Table 3, along with a brief assessment of the progress made in the last decade toward implementing the recommendations.

Table 1. DOD Report Card on Recommendations from 1998 DSB Report

Recommendation	Status
Support deterrence thought by institutions outside government and National Defense University	Instituted
Services track nuclear experience in the personnel system	Instituted
Render annual report to President on nuclear deterrent	Not done since 2001
Commanders emphasize operational exercises and inspections for nuclear forces	Doing now
Air Force, Navy, DTRA continue rigorous operational inspections	Doing
Maintain proven and essential triad of nuclear forces	Retained
Study rationale before additional de-alerting	No additional de-alerting done
DOD leadership act to reverse decline in value of nuclear experience	Not done
Under Secretary of Defense for Acquisition and Technology (USD [A&T]) establish mechanism to surface nuclear issues to right level with right staff support	Not done
Raise Intelligence Community priority for nuclear issues	Not done
Air Force and Navy establish and maintain long range plans [>20 years ahead] for nuclear delivery systems	Air Force not done
USD (A&T) and DOE (Defense Programs [DP]) develop mutual understanding of Stockpile Stewardship Program (SSP) as basis for long-term DOD support	Done thru Nuclear Weapons Council
DOD/DOE take concerted effort to educate the Congress and other decision-makers on imperative of SSP success	Done
DOE (DP) form an independent review group with DOD participation to assist the senior leadership in national security community in confidence in developing SSP	Unknown

Note: This table records the status of recommendations made by the 1998 DSB Task Force from 1998 until the present.

Table 2. DOD Report Card on Recommendations from 2006 DSB Report

Recommendation	Status
SECDEF should set direction and priorities for next generation strategic strike systems	Unknown
Establish DARPA office to define and conduct exploratory development of long-term strategic strike concepts	Not done
Ballistic missile program offices should resource transfer of internal skills and knowledge to younger personnel in industry	Mixed results
SECDEF should direct Navy and Air Force to fund advanced development to support next generation systems	Not done
SECDEF ensure Navy and Air Force application programs are funded at originally recommended STRATCOM Strategic Advisory Group levels	Goals not met
Strategic strike program offices should encourage and fund supporting industries to develop relevant cooperative and scholarship programs	Not done
USD (AT&L) ensure strategic strike organizations (military, civilian, industry) have domain-knowledge management systems	Not done

Note: This table records the status of recommendations made by the 2006 DSB Task Force from 1996 until the present. DARPA is the Defense Advanced Research Projects Agency.

Table 3. DOE/NNSA Report Card on Recommendations from 1999 Commission

Recommendation	Status
1. Reinforce national commitment and fortify the sense of mission	Weak
2. Complete integrated, long-term stockpile life extension plan	Slow implementation
3. Strengthen DOE-DOD relationship	Improved
4. Achieve greater laboratory coordination	Improved
5. Expedite improvement and efficient use of production complex	Progress
6. Establish clear lines of authority within DOE	Mixed results
7. Implement plans to replenish essential technical workforce	Progress
8. Provide contractors with expanded personnel flexibility	No change
9. Expand training and career planning programs	Progress
10. Expand the use of former nuclear weapons program employees	Improved
11. Create a permanent Defense Programs Advisory Committee	Not done
12. Enhance congressional oversight	Not improved

Note: This table records the status of recommendations made by the 1999 Commission, from 1998 until the present.

The necessity for the mission is seldom articulated by senior government officials. The national commitment to the mission and the vital role it plays in the security of the nation remain weak at best. Most notably, implementation of an integrated, comprehensive, and long-term stockpile life extension plan has been slow. In the past 15 years, only one major stockpile life extension program has been completed for Minuteman and one has just begun for Trident. There have always been plans, but the reality is that the design-development-production work for the nuclear weapon complex has been far from steady and predictable over the last 15 years. This issue is a major stumbling block to ensuring NNSA proficiency over the long term.

Since the 1999 Commission report, the nuclear weapon complex has made progress in recruiting, training, and retaining the right level of technical talent for the mission, including making use of retirees. However, the NNSA workforce of government and contractor personnel is old relative to the U.S. workforce. The weapons laboratory contractors are old relative to the U.S. population of PhD scientists and engineers in the workforce. Across all NNSA sites, the population over 40 is in the 70 to 80 percent range. The percent of the workforce eligible to retire has grown since the Commission report in 1999, but not as fast as had been projected. Recent hiring rates are a trickle compared to the pool of eligible retirees at the NNSA facilities and the rate at which people could retire in the next five years.

In general, across a wide range of survey questions (similar or the same as those used in 1998), employee responses to the current survey strongly indicate that the NNSA government and contractor workforce attitudes are more positive than reported in 1999. Attitudes are distinctly more positive at the NNSA production plants than reported in 1999. However, attitudes about the future are more negative at Los Alamos and Lawrence Livermore National Laboratories in the face of impending workforce layoffs, most notably at Los Alamos.

There is concern about recruitment in specific knowledge fields as discussed in this report. However, this task force's view is that the lack of national commitment to the nuclear weapons program and the lack of a stable base workload of design-development-production work will eventually erode the capability to attract the right level technical talent across a wide spectrum of skills needed to maintain competence.

NNSA Defense Programs does not have an advisory committee. **In general, Congressional interest, oversight, and support of the nuclear weapons program continues to need invigoration.**

Methodology

To cover the range of nuclear skills identified in the Terms of Reference, the scope of this effort was necessarily broad. The task force investigation extended to the entirety of personnel whose responsibilities include the evaluation, management, or execution of any element of nuclear weapon systems—that is, the integrated nuclear weapon, launch, or carrier vehicle, and supporting command, control, communications and intelligence, surveillance, and reconnaissance (C3/ISR) infrastructure These elements span policy, research, development, testing, production, acquisition, deployment (including security), operational training, and operational employment.

Also included are those personnel responsible for understanding and, where possible, defeating potential nuclear weapons threats to U.S. interests—nuclear weapons effects such as electromagnetic pulse, shock, overpressure, and neutron, x-ray and gamma radiation; collateral damage and other fallout; as well as nuclear weapons or materials being smuggled out of legitimate repositories for illegal transfer to adversaries hostile to the United States and its allies. Table 4 captures the actors and areas that the study addressed.

To accomplish this extensive study of nuclear deterrence skills, the task force embarked on a four-part fact-finding effort that included:[2]

- briefings to the task force from the range of organizations and facilities identified in Table 4
- site visits to key installations and facilities
- data requests
- workforce survey

2. Presentations to the task force and location of site visits are included at the end of this report.

Table 4. Scope: Nuclear Deterrence Capability Areas, Expertise, Organizations, and Facilities

Kinds of Expertise	Organizations and Facilities
• Intelligence (understanding adversary, asymmetries, potential opposing weapons) • Strategy and policy • Science and technology • Weapons effects (offense and defense) • Nuclear detection • Systems analysis • Engineering and development • Design • Manufacturing and sustainment • Management • Planning and executing military operations	• Department of Defense – U.S. Strategic Command – U.S. Joint Forces Command – Military departments and services – Office of the Secretary of Defense and Joint Staff – Combatant commands (Northern Command, Pacific Command) – Defense Threat Reduction Agency – Missile Defense Agency • Intelligence Community • Department of Energy – Headquarters (NNSA, Office of Science, Environmental Management, Office of Non-proliferation) – Laboratories – Production facilities – Test facilities • Industry and Federally Funded Research and Development Centers – Policy centers – System integrators and systems analysis – Manufacturers – Supporters

Through this approach, the task force was able to draw insights from those involved in most aspects of the weapons programs and from many levels of the organization. Site visits included not only briefings from senior officials but focus groups and one-on-one sessions with individuals in the nuclear career field. Their experiences and observations, combined with survey results of an even larger population of the workforce, provided important inputs into the task force assessment, directly influencing its findings and recommendations.

After highlighting, in the section below, the principal observations that emerged from the task force investigation, the remainder of this report will detail the findings and recommendations of this study. It begins with an overview of the nuclear threat and the need for a national commitment in response. The report then focuses on the task force findings which fall into eight areas: DOD nuclear weapons work, NNSA expertise, intelligence, military operational competencies, weapons effects, domestic nuclear event response capability,

reorganizations and staff reductions, and personnel management. The final chapter provides recommendations for the way ahead. Findings and recommendations are highlighted in bold print.

Principal Observations

The cumulative work conducted by the task force has lead to the following principal observations:

- The task force is concerned that adequate nuclear deterrence competency will not be sustained to meet future challenges.
- National strategy has not been emphasized and, as a consequence, there is disillusionment that could lead to decline in the remaining critical skills.
- Existing and emerging WMD threats and adversary intentions are not well understood. Intelligence assessments lack the needed focus and expertise.
- The perception exists that there is no national commitment to a robust nuclear deterrent, reflected in downgrading activities within OSD policy, the Joint Staff, STRATCOM, U.S. Air Force, and congressional action on the RRW.
- Management and work force in industry and the nuclear weapon contractors believe that "sustainment" programs (*e.g.* life extension programs [LEPs]) will not retain skills necessary to competently solve major problems with existing systems or initiate new programs.
- Pessimism exists about follow-on nuclear deterrence systems becoming a reality.
- Priorities have shifted strongly, and to a degree appropriately, but the pendulum has swung too far. Now we are faced with about $100 billion of decisions (RRW, Complex Transformation, land-based strategic deterrent, sea-based strategic deterrent), with an eroded capability to think about these issues.

Chapter 2. Nuclear Threats and National Commitment

The Threat Environment

At the start of World War II, the most urgent nuclear threat was the possibility that Nazi Germany was secretly pursuing a nuclear weapon and might acquire that capability in the short term. During the Cold War, the most urgent threat was posed by the Soviet Union. The most urgent nuclear threats facing the nation today are nuclear terrorism and nuclear proliferation. As well, all other nation states with nuclear weapons are still developing weapons or continuing technology initiatives.

While it is difficult to predict what the most urgent nuclear threat will be in the future, it is prudent to assume that there will continue to be nuclear threats. Tens of thousands of nuclear weapons were produced around the globe since the advent of the nuclear age. We cannot know with certainty where all of the weapons or their components are. Even if all nuclear weapons were somehow eliminated today, the knowledge of how to make them and the fissile materials required for their construction would still remain, as well as the ability to develop radiological weapons ('dirty bombs'). The nuclear dimension, in short, cannot be removed from the threat equation now or in the conceivable future. It can at best be managed. And we cannot rule out the possibility that in the decades ahead a significant number of nuclear weapons again could be directed at the United States, our forces abroad, and/or our allies and friends.

Today's overall threat environment is increasingly complex. Globalization has broadened the number of threats and challenges facing the United States. To cope with the new complexity, the Defense Department in its *2001 Quadrennial Defense Review* (QDR) shifted its military planning from a threat-based to a capabilities-based approach.[3]

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3. "The new defense strategy is built around the concept of shifting to a 'capabilities-based' approach to defense. That concept reflects the fact that the United States cannot know with confidence what nation, combination of nations, or non-state actor will pose threats to vital U.S. interests or those of U.S. allies and friends decades from now." *Quadrennial Defense Review Report* (September 30, 2001), p. 13.

Senior American officials continue to think and talk in terms of threats, however. The National Security Strategy, issued under the President's signature, states that the first duty of the government is to protect the American people and American interests. This duty "obligates the government to *anticipate and counter threats* [emphasis added], using all elements of national power, before the threats can do grave damage."[4] The strategy argues that the proliferation of nuclear weapons poses the greatest threat to national security and acknowledges that nuclear weapons have a special appeal for terrorists and states of concern (also sometimes called rogue states).

In the most recent annual threat statement by the Director of National Intelligence to the Congress, the ongoing efforts of states and terrorists to acquire (and if they already possess them, to improve) nuclear weapons/postures are highlighted. Al-Qa'ida and its affiliates are discussed extensively, Iran and North Korea are identified as specific concerns, and the nuclear competition between India and Pakistan is discussed briefly (as is the question of Pakistan nuclear security given the ongoing political uncertainty in Pakistan). Further, the judgment is advanced that China's nuclear capabilities will increase rapidly in terms of range, lethality, and survivability over the next ten years, and the revival of Russian national power (to include its military power) is noted.[5]

The National Security Adviser spoke at Stanford University on February 11, 2008, stating that the "threat of a nuclear attack on the American homeland remains very real—although the nature of the threat has changed dramatically over the last two decades," and focusing on "the proliferation of nuclear weapons and nuclear materials into the hands of nations or individuals who would do us harm."[6]

Major nations other than the United States, including Russia and China, continue to modernize their nuclear postures, sustain and extend nuclear expertise, and develop new doctrines for nuclear forces. The range of current and potential nuclear threats extends across the full spectrum from nuclear terrorists, to hostile regional powers, to hostile major powers. Even if nuclear weapons were somehow banished by political agreement, a latent nuclear threat would remain. In today's world, given the dynamics of proliferation, a regional

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4. *The National Security Strategy of the United States of American* (March 2006), p. 18.
5. J. Michael McConnell, Director of National Intelligence, *Annual Threat Assessment of the Director of National Intelligence for the Senate Armed Services Committee* (27 February 2008).
6. Remarks by Stephen Hadley, National Security Advisor, to the Center for International Security and Cooperation, Stanford University, Stanford, California (February 11, 2008).

nuclear confrontation not initially involving the United States can threaten vital U.S. interests as well.

It is important to acknowledge that the threat environment in which nuclear threats exist also includes other high-priority military capabilities (cyber warfare and counter-space), potent non-military capabilities (the use of financial or energy leverage to achieve political ends), other weapons of mass destruction (especially biological weapons), and advanced military technologies and systems.

In short, our nation's ability to deal with the current and anticipated threat environment calls for a base of nuclear expertise that is even broader than it was during the Cold War. The challenge of sustaining nuclear expertise in such a diffuse and rapidly evolving threat environment is daunting. Deterrence and nuclear operations can turn out to be far different from those supported by the nuclear enterprise during the Cold War. The detonation of a single terrorist nuclear weapon in a major city is a strategic problem demanding a rigor to technically informed analysis that once was devoted to civilization-threatening arsenal exchanges.[7] China and Russia now appear to consider nuclear attack options that, unlike their Cold War plans, employ electromagnetic pulse (EMP) as a primary or sole means of attack.[8] However, they have at their disposal hundreds and even thousands of weapons that can be used as they see appropriate when the time comes. Tactical and regional use of nuclear weapons is a demanding and quite plausible problem. So is detecting, capturing, and rendering safe a nuclear weapon that is being smuggled for terrorist use.

Nuclear Weapons Consensus

Conditions of the Cold War helped foster a strong national commitment and consensus on developing, maintaining, and operating a nuclear deterrent force and preserving nuclear expertise that was second to none. That consensus allowed for considerable disagreement on details and priorities, but it was sufficiently coherent and deep-rooted across political and intellectual divides that it helped underwrite a clear national commitment to the nuclear deterrence mission. U.S. allies and foes knew this. So did the men and women in the

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7. One of the major challenges posed by nuclear terrorism is the nuclear forensics challenge, *i.e.*, identifying the origin of a nuclear weapon. See the report of the Joint Working Group of the American Physical Society and the American Association for the Advancement of Science, *Nuclear Forensics: Role, State of the Art, Program Needs* (2008).
8. *Joint Defense Science Board/Threat Reduction Advisory Committee Task Force on The Nuclear Weapons Effects National Enterprise* (forthcoming).

American nuclear weapons enterprise. They lived in a culture that continually refreshed the reservoir of nuclear deterrence expertise.

There also was a consensus during the Cold War to oppose nuclear proliferation, although in practice this consensus allowed for many compromises. Nevertheless, it is worth noting that the fundamental framework of today's nuclear nonproliferation regime was the result of American leadership exercised on a number of occasions by a number of different administrations and Congresses, spanning decades of time.[9]

Nobody wants to return to the Cold War. As the American Secretary of Defense told Russia's leaders in 2007, one Cold War is enough in anyone's lifetime. It arguably was inevitable with the end of the Cold War and the collapse of the superpower confrontation that the role for nuclear weapons would devolve away from center stage, at least for the United States with its strong armed forces across the board. What was not inevitable was the steep decline in national consensus in the United States as to what was needed for the nuclear deterrence mission.

In part, the lack of national consensus results from the more complicated threat environment. Attention is paid to core nuclear issues, but they are not the same core nuclear issues that animated consensus in an earlier era. Nuclear proliferation and nuclear terrorism today are the primary focus of American policy, not deterrence of major-power nuclear war.

This task forces finds that the extent to which a national nuclear weapons consensus still exists in this country, it resides in the propositions that the United States should not renounce its nuclear weapons while other countries have them, that America's nuclear weapons should be as safe and secure as possible, and that nuclear terrorism and nuclear proliferation are near-term threats requiring high-priority responses.

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9. In 1946, at the dawn of the nuclear age, the Truman administration presented the Baruch Plan as a means to deal with potential proliferation. President Eisenhower's proposals in his December 1953 "Atoms for Peace" speech led to creation of the International Atomic Energy Agency and its safeguards program. Negotiations on controlling nuclear testing, led by American initiatives, began in the Eisenhower administration and extended through the Clinton administration. The Johnson administration negotiated the Nuclear Non-Proliferation Treaty and the Nixon administration supported its ratification and entry into force. Many of the laws and supplier controls addressing nuclear proliferation were put in place in the Carter administration. The Bush (43) administration has championed international fuel bank and nuclear energy programs designed to strengthen the nuclear nonproliferation regime. Congress in many instances has been a proactive player in the nuclear nonproliferation realm.

It may also extend to other propositions as well. One is that the United States should have the strongest possible intelligence capabilities for understanding foreign nuclear weapons activities. Another is that a major improvement is needed in technical and operational capabilities to detect nuclear weapons being smuggled into or toward the country, and to attribute responsibility for a nuclear explosion. The limited consensus does not extend to what should be a bedrock proposition—namely, that so long as anyone on earth has a nuclear weapon or has the ability to get a nuclear weapon, American nuclear expertise should be second to none.

Today there appears to be deep disagreement in the American body politic on almost every nuclear weapons issue: the role of nuclear weapons, retention of nuclear alert operations, whether to declassify nuclear stockpile numbers, the wisdom of nuclear modernization plans such as the Reliable Replacement Program, whether to ratify and use American influence to bring into force the Comprehensive Test Ban Treaty (CTBT), and whether the regime built around the Nuclear Non-Proliferation Treaty can be relied on in the future. This situation contributes to political deadlock and drift and to the continued decline in nuclear expertise documented in this study. There also continues to be a lack of appreciation by senior American leaders that this decline is serious.

A necessary, although far from sufficient condition for reversing that decline is for the Executive Branch and Congress to arrive at a new national consensus and commitment on the need for nuclear weapons, a connected strategy for dealing with all issues raised by nuclear weapons, and a determination of the specifically nuclear deterrent requirements that flow from these.

This is not the first study to identify erosion of national consensus as a fundamental issue for the health of the U.S. nuclear expertise endeavor. The capstone recommendation of the 1999 *Report of the Commission on Maintaining United States Nuclear Weapons Expertise* was a call to reinforce the national commitment and fortify the sense of mission.[10] In a similar vein, the initial key issue identified by the 2006 *Report of the Defense Science Board Task Force on Nuclear*

10. "The Administration and the Congress, through actions and words, should make a concerted and continuing effort to convey to the nuclear weapons community that their mission is vital to the security of the nation and will remain vital well beyond the planning horizons normally associated with programmatic decisions. This message should be unequivocal, clear, and periodically reinforced." *Report to Congress and the Secretary of Energy of the Commission on Maintaining United States Nuclear Weapons Expertise* (March 1, 1999).

Capabilities was the absence of a national consensus on the nature of the need for and the role of nuclear weapons.[11]

During the Cold War, nuclear deterrence was at the heart of American national security strategy. Some of the best minds inside and outside of government were devoted to this topic. Although the details of the nuclear deterrent strategy changed over time through a succession of administrations, the Executive Branch and Congress largely agreed on the imperative to keep the nuclear deterrent strong.

After the Cold War nuclear deterrence no longer played the central role it once did in American security affairs—a well documented fact that requires little elaboration. This state of affairs naturally required a broad range of adaptation in the American nuclear enterprise. So did the congressionally mandated end to nuclear testing in 1992, followed by negotiation (but not formal entry into force) of the Comprehensive Test Ban Treaty.[12] Geopolitically, the threat environment shifted as nuclear proliferation and nuclear terrorism evolved in disturbing new directions. Nuclear issues became more, not less, complex in a rapidly changing world.

The United States has invested heavily in the transformation of its armed forces into a powerful instrument that many would argue can achieve a number of effects that nuclear deterrence once offered, with America's unmatched non-nuclear means. This outcome is welcome in many ways, but it further contributes to the erosion of nuclear expertise as those who once would have devoted their careers to being expert in nuclear affairs turned their attention elsewhere.

As for the evolution of the public face of nuclear deterrence policy guidance, on May 1, 2001, the President gave a major speech at National Defense University where he argued that "we need new concepts of deterrence" and that deterrence "can no longer be based solely on the threat of nuclear retaliation." He called for a new framework incorporating missile defenses that would

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11. "There is agreement [in the United States] that the overriding priority for the U.S. nuclear weapons enterprise is to provide and sustain a reliable, safe, secure, and credible set of nuclear weapons needed to maintain the nuclear deterrent. There is no national consensus on the nature of that need." *Report of the Defense Science Board Task Force on Nuclear Capabilities* (December 2006).

12. In April 1993 at the Vancouver summit, Presidents Clinton and Yeltsin agreed to seek early multilateral negotiations on a CTBT. Talks began in Geneva in January 1994 in the Conference on Disarmament and by the autumn of 1996, had resulted in a threat. The United States was the first to sign the treaty when it was opened for signature at the UN General Assembly in September 1996. The CTBT was submitted to the Senate one year later, where it was placed on a slow track. In October 1999, the Senate rejected the CTBT. Nevertheless, the United States has continued to observe a nuclear testing moratorium.

strengthen deterrence, reduce the incentive for nuclear proliferation, and allow for further reductions in nuclear weapons. The President argued that nuclear weapons "still have a vital role to play in our security and that of our allies" but did not further elaborate that role.[13]

In addition to the President's speech, other announcements later in 2001, that took place after the traumatic events of 9/11, further shaped the nuclear framework—the nation's intent to reduce its operationally deployed nuclear weapons to 1,700 to 2,200 in number[14] and formal notification to Russia of its intent to withdraw from the Anti-Ballistic Missile Treaty.[15] The new imperatives of combating global terrorism intersected the QDR and NPR of 2001 to provide an evolving vision, framework, and strategic priorities for defense planning, albeit a framework that left unclear in the public mind what specifically would henceforth define nuclear deterrence.

The associated framework for combating WMD that was outlined in the *National Strategy to Combat Weapons of Mass Destruction* (December 2002) and the *National Military Strategy to Combat Weapons of Mass Destruction* (February 2006) is elaborate, still evolving, and further submerges thinking about nuclear deterrence and its requirements in a broader set of issues. The *Report to the President by the Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction* (March 2005) and the QDR report of February 2006 is very broad as well.

Hence, thought specifically addressing nuclear deterrence and its requirements has become defocused and has been shifted to ever-lower levels in the national security establishment over time. The task force believes that this combined set of factors contributes to the current state of affairs across all sectors of national security expertise—from policy to planning (intelligence and targeting), from project management and acquisition to weapons effects, from design and logistics to safety and security, from command and control to operations and execution—in Congress as well as the executive branch. The result is that a number of the personnel engaged in the nuclear weapons enterprise believe their work is important and underappreciated.

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13. Remarks by the President to the Students and Faculty at National Defense University, May 1, 2001. http://www.whitehouse.gov/news.
14. This announcement, made with President Putin present at the Crawford summit in November 2001, was the U.S. position reflected in 2007 Treaty on Strategic Offensive Reductions signed at Moscow by the two presidents in May 2007.
15. This announcement was made at the White House in December 2001.

In 2007, in the midst of the debate over the future of the RRW, the Secretaries of Energy, Defense, and State submitted a short statement on U.S. national security and nuclear weapons entitled "Maintaining Deterrence in the 21st Century."[16] This high-level engagement did not create support for the RRW, and in its FY 2008 defense authorization and appropriation actions, the Congress now has called for a new NPR, a commission on the strategic posture of the United States, and a commission on the prevention of WMD proliferation and terrorism.

At the same time, a distinguished community of retired senior American national security officials has helped spearhead the call for a new strategic vision of American nuclear requirements.[17] All of this takes place against the backdrop of an upcoming presidential election where national security affairs are playing a prominent role and where a strategic vision of a different nuclear future is being addressed explicitly by leading candidates.

The task force concludes that the erosion of U.S. nuclear deterrent expertise cannot be reversed absent a renewed national commitment and strong leadership.

16. The statement signed by Secretaries Bodman, Gates, and Rice was submitted to the congressional leadership on July 20, 2007.
17. See George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn, "A World Free of Nuclear Weapons," *Wall Street Journal*, January 4, 2007, p. 15.

Chapter 3. DOD Nuclear Weapons Work

The industrial base skills that created and sustained DOD's nuclear deterrent capabilities over the past 60 years are substantially less than they once were, and are in danger of significant further erosion in the area of ballistic missiles. DOD programs are managed by the services and they rely upon a program management structure featuring a program office responsible for implementing national guidance through design, development, sustainment, and operations of the weapon systems, including integration of the NNSA-supplied weapons. The service program management team typically relies upon a contractor team (prime and its subs or an associate contractor arrangement) to achieve its goals.

In the absence of continuing development programs, it is increasingly dubious whether the DOD nuclear deterrence infrastructure, especially its human capital, can be characterized as "responsive" as called for in the 2001 NPR. Any new programs will require time for recruiting and training new employees; dependence upon inexperienced employees is likely to stretch out development times and even then result in program delays and developmental failures on the way to program completion. The magnitude of the problem will vary by weapon system type but appears to be most significant with respect to ballistic missiles.

Industry is uniformly emphatic that expertise can only be maintained by the exercise of skills requiring funded programs for which the skills are necessary. The skills that are being exercised today for nuclear-capable deterrent forces are almost exclusively related to the less demanding sustainment of the systems first deployed many years ago: Minuteman III, Trident D5, B-52, B-2, air-launched cruise missile (ALCM), Tomahawk Land Attack Missile-Nuclear (TLAM-N), F-16, and F-15. The nuclear deterrence industrial base for aircraft and standoff weapons now depends on non-nuclear weapon system activities for its sustainment, but in important areas no surrogates exist. The industries that have supported the nation's long-range ballistic missile capability are clear that design and system engineering skill in areas unique to strategic missiles will disappear in the near term in the absence of new programs. Even the life extension programs that exist for some of these systems are scheduled to conclude in the near future.

The program management structure used by the services to conduct the weapons systems programs (design, develop, produce, deploy, and sustain) relies

upon a variety of management models. For example, the Air Force intercontinental ballistic missile (ICBM) program from inception in 1954 used an associate contractor structure with individual contractors having responsibilities (deliverables) for specific elements of the weapon system. The contractor team was integrated by the program office with the assistance of a systems engineering contractor. In 1997, the ICBM program shifted to a smaller program office that engaged a prime contractor to integrate and manage the elements of the life extension programs. The Navy submarine launched ballistic missile (SLBM) program from inception has had not only acquisition but also operational responsibility. A dedicated industry team with defined responsibilities for missile system, guidance, fire control, etc., has been integrated by the program office to meet operational requirements. The Air Force bomber and cruise missile programs have historically used program office/prime integrating contractor arrangements in which the small program offices are located with the acquisition commands and the prime integrating contractors manage the design, development, and production of the elements of the system from facility locations around the country.

The continuous modernization of nuclear capable forces (*e.g.* for ICBMs Thor, Atlas, Titan I, Titan II, Minuteman I, Minuteman II, Minuteman III, MX) that existed until the early 1990s ensured that the skills needed for the job were rigorously exercised, and kept pace with evolving technology. The challenge of new systems brought a continuing stream of eager, intelligent workers into the force to work side-by-side with experienced mentors. New systems exercised the skills needed for research, design and system engineering, development, testing, and production. Even system concepts that were never deployed (such as, for ICBMs, deep underground, rail mobile, off-road mobile, air-launched) fully engaged the design and engineering skills while the concepts were evaluated.

Today, there are no new funded nuclear deterrent systems or exploratory development programs for which to recruit, develop, and exercise relevant skills. New non-nuclear system concepts, like the Air Force's Common Aero Vehicle and Navy's Conventional Trident Modification (CTM) program would have contributed significantly to keeping some nuclear-relevant design and system engineering skills alive. The 2008 defense legislation deleted funding explicitly requested for these programs (prohibited use of funds for CTM). It did, however, allocate half the total $200 million sought to a defense-wide account that could be applied to propulsion and guidance systems, mission planning, re-entry vehicle design, modeling and simulation efforts, command and control, launch system infrastructure, intermediate-range missile concepts, advanced non-nuclear warheads, and other mission-enabling capabilities. To a

certain extent, these funds may sustain programs previously funded by the Application Programs in Re-Entry, Propulsion, and Guidance that had been drastically cut by the Air Force and Navy, despite their long-term advocacy by those concerned with the demise of industrial base personnel competency in these crucial and uniquely nuclear-related areas.

While application of funding to technology in these areas via the Application Programs was helpful, industry had always been clear that these programs alone could not sustain competency. The 2008 $100 million program managed by OSD could continue to be helpful to skill preservation in areas important to nuclear ballistic missile systems, depending upon how funds are applied. The delay in commitment to specific system development programs poses the threat that employees who once brought the current systems into existence will retire before they can train a next generation of work force on any new systems.

The remainder of this chapter addresses each nuclear deterrent system capability in more detail.

Intercontinental Ballistic Missile

The first version of the Minuteman III (MMIII) entered the force in 1970. An extensive life extension program has been underway that includes replacement of the aging guidance system; remanufacture of the solid-propellant rocket motors; replacement of standby power systems; repair of launch facilities; and installation of updated, survivable communications equipment, and new command and control consoles to enhance immediate communications.

With these changes, the projected lifetime of MMIII calls for retirement beginning in 2020. Speculation about extended retention of MMIII until 2030 has begun. **To date no analysis has been performed to support such a retirement extension nor has funding been provided that would permit surveillance sufficient for early enough detection of incipient failures in time to develop and deploy a replacement before major problems developed in the deployed system.**

Expertise that provided the designs for hardened and survivable launch control facilities, silos, communication, launch systems, reentry systems, and offensive countermeasures is not now available. It is estimated that fewer than 5 percent of those once responsible for assessing the damage effectiveness of ICBM targeting remain available.

The Air Force's Land-Based Strategic Deterrent Analysis of Alternatives study to address the successor to MMIII was completed in 2005. No action has been taken since on a replacement system. It was reported that the Air Force has not undertaken any effort to reassess the state of industrial skills needed to sustain, let alone undertake, new ICBM programs, nor has it motivated or provided incentives to industry to evaluate the state of its critical skills or propose programs that might sustain expertise in the most critical areas. Under these circumstances, the industries that supported the ICBM force have no motivation to preserve design and system engineering critical skills or recruit new talent to this task. An evaluation performed by the Air Force ICBM Program Office in 2004, concluded that skills would be below a critical mass in the areas of guidance, re-entry, and propulsion no later than 2010, and reconstitution would carry significant risk. No subsequent action has been taken to reverse these conclusions.

Submarine-Launched Ballistic Missile

The Navy's Strategic Systems Programs (SSP) organization manages the SLBM activities from cradle to grave and has been cognizant of the challenge to maintaining excellence in industrial skills in all technical areas relevant to SLBM since the early 1990s. The current SLBM capability is 14 Ohio-class ballistic missile submarines (SSBNs) outfitted with Trident-II (D5) missiles. A D5 Life Extension program currently underway is expected to extend the service life of the weapon system until 2042. Thus, a next generation SLBM design and engineering effort is at least 10–15 years in the future. As a result, some shipboard systems based on commercial off-the-shelf components, such as fire control and submarine navigation, have been planned for periodic refresh cycles that exercise relevant critical skills. Industrial partners have incentives to track critical skills and develop critical skill preservation programs, although compliance has been mixed. The life extension program has been sufficient for training and transferring knowledge to the next generation of inertial guidance and electronic engineers. However, in the areas of propulsion and re-entry, the life extension program has not offered the opportunity to train another generation of designers and system engineers.

A most promising recent development is the proposal to continue D5 missile motor production at the rate of 12 per year. This proposal would ensure that some large diameter rocket motor production skills, that were once predicted to die as early as 2012, would be sustained and available for future SLBM and ICBM application. However, essential expertise for the design and development of hardened reentry systems remains at risk.

Aircraft and Air Breathing Systems

The B-52H (delivered to Air Force 1962) and B-2 (first flown 1989) are the current long-range aircraft capable of nuclear delivery via lay-down bombs and cruise missile (ALCM). Until the June 2006 announcement that the Air Force would begin to examine a next generation strategic bomber, it had been expected that the existing aircraft would be the sole capability until 2040. It remains unclear how soon the replacement aircraft will be available, although 2018 has been stated as an objective by the Secretary of the Air Force. Effects of nuclear engagements (surface-to-air missile encounters, fratricide, etc.) on aircraft performance are now, at best, a low priority for the Air Force. The Air Force Weapons Laboratory, once responsible for leading analysis and experimentation, no longer exists.

Unlike the missile area, industry has remained confident that the production of large body commercial aircraft and tactical military aircraft has retained the critical skills needed to design, develop, and produce a new nuclear-capable strategic aircraft. The task force finds no reason to doubt these conclusions by industry with the exceptions of two areas: aircraft survivability to nuclear effects and meeting nuclear surety requirements. With respect to the latter, modern technology might make this task much simpler and less expensive than it was in the past. It is not too soon to aggressively explore this possibility to understand what can actually be achieved.

The Navy's nuclear-capable TLAM-N (delivered in 1984) and the Air Force's nuclear-capable ALCM (delivered in 1981) have both been allowed to wither technologically, as there have been no upgrades since initial production two decades ago. (The more recent nuclear-capable Advanced Cruise Missile is being retired.) However, very aggressive conventionally armed cruise missile development has kept pace with technology (most recently TACTOM Block IV for the Navy and JASSM-ER for the Air Force). This development provides an experienced skill base in virtually all relevant technical areas should a next-generation sea-based or air-delivered nuclear-capable standoff missile be required. As noted in the above discussion of long-range bombers, most glaringly the design and system engineering skills important to nuclear-armed standoff missile surety and survival to nuclear effects are not being exercised in current cruise missile programs and, hence, would introduce risks in any future development.

The F-15 (delivered in 1974) and F-16 (delivered in 1979) are nuclear-capable, while the more modern F-22 is not. The next generation nuclear-capable

short-range aircraft is scheduled to be the F-35 Block 4 which would come on-line in 2020 as the F-15 and F-16 retire. Ongoing design and engineering efforts for the F-22 and F-35 and similar commercial aircraft activities continually exercise most of the skills needed to accomplish a nuclear-capable F-35 Block 4, with the same exceptions noted above regarding skills for survival to nuclear effects and to meet nuclear surety requirements.

Chapter 4. NNSA Nuclear Weapons Expertise

The DOE/NNSA relies upon a management structure for implementing its responsibilities to national guidance that is based upon a "government owned/contractor operated" arrangement across the weapons program sites developed during and shortly after WWII (the "weapons complex"). In practice, the work force, though contractors, actually functions as "pseudo government" employees with only the top management of the sites representing a contractor interest. That is, management teams operate the laboratories, production plants, and test sites for NNSA, but the resident work force typically remains in place as the contractor management leadership changes through contract awards.

NNSA competency begins with the quality of the technical staff it can attract and retain at headquarters and within the contractor workforce for its nuclear deterrence mission. For this purpose, NNSA competency is defined as the demonstrated ability of the agency to execute its mission to provide the United States with a safe, secure, and reliable nuclear weapons stockpile. This definition of competency also requires a judgment about the timeliness of mission execution; proficiency is perhaps a better word to describe this attribute.

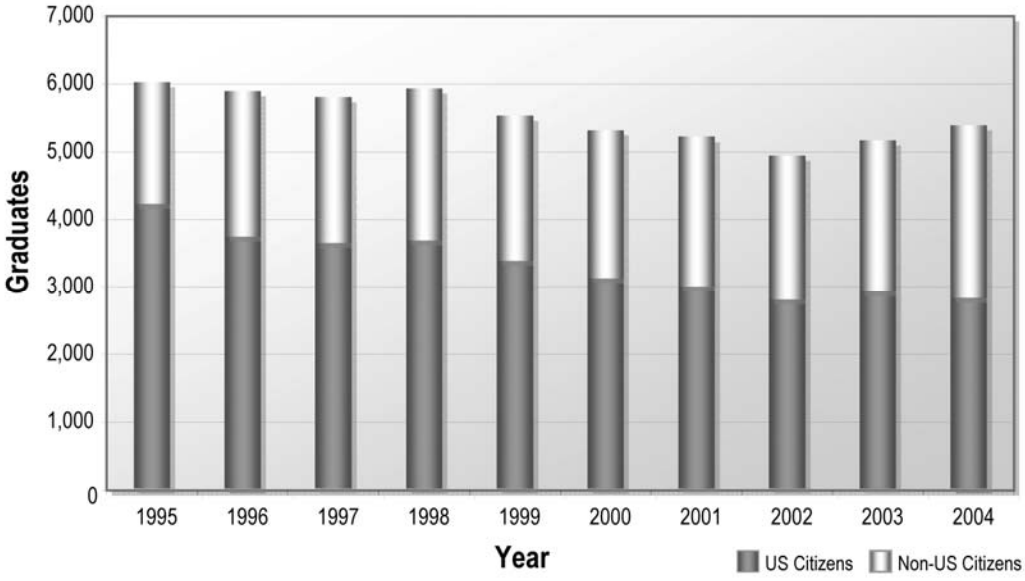
The framework used for assessing NNSA's competence to perform its mission is comprised of three main elements: basic educational qualifications, workforce training to acquire nuclear weapons knowledge, and experience gained by actually performing the mission.

Basic Educational Qualifications

In general, there does not appear to be a current problem in recruiting high caliber technical graduates to the NNSA and its contractors. There are two main areas of concern—computer science/engineering and nuclear engineering. Graduates in computer science/engineering are in high demand both nationally and internationally. This talent is most critical for the NNSA weapons laboratories. While the weapons laboratories may not be able to compete with private industry salaries, they do offer the opportunity to work with some of the most advanced computation and simulation capabilities in the world.

Graduates in nuclear engineering are scarce because the demand has been low since the United States stopped building new civilian nuclear power plants several decades ago. Current plans for building new nuclear power plants in the United States may create the demand that will expand the nuclear engineering programs offered by U.S. universities. On the other hand, growth in the civilian nuclear power industry could also siphon away graduates from nuclear national security missions. Today, NNSA and the contractors report that they are able to find qualified recruits for critical positions.

There is concern that, in the long term, recruitment of high caliber technical talent for the NNSA and its contractors will be challenged by the general decline in the proportion of U.S. citizens acquiring post-graduate degrees in science and engineering at U.S. universities (Figure 2). A DOE "Q clearance" is required for virtually all nuclear weapons mission-critical skills, and U.S. citizenship is a requirement. This diminishes the talent pool available to the NNSA for its nuclear weapons mission, and it is particularly troublesome for the weapons laboratories that need the highest caliber technical talent.



Note: Includes degrees in computer science, math, physics, astronomy, and chemistry.

Source: The Evolution of OSD Nuclear Policy Organizations, 1991–2007

Figure 2. U.S. PhD Degrees in Science

In both the short and long term, retention of the right caliber technical staff for the mission will depend significantly on staff perception of the national importance of the mission and the amount of time they are allowed to spend on the technical aspects of the mission. A number of staff interviewed perceived the nuclear weapons enterprise as a declining industry. While it varied considerably by site, staff interviews left the impression that a significant number of managers and staff would not recommend a qualified friend or family member pursue a career in the nuclear weapon field. The survey results were less gloomy, with about 72 percent of the respondents at the laboratories, 79 percent at the production plants, and 68 percent at NNSA headquarters saying they would recommend their organization as a good place to work.

Workforce Training

Specific knowledge of the science and engineering of nuclear weapons is not taught in universities. Further, many of the technologies used in executing the nuclear weapons mission are either not used, or not used in the same way, as commercial industry. So there is an appreciable NNSA investment required to clear, train, and mentor new hires in the arcane practices of nuclear weapons design, development, test, manufacture, and assessment. The following observations are made about workforce training.

The NNSA and its contractors have invested in knowledge retention programs, intern programs, future leaders programs and alike since the end of the Cold War. While they should continue to make these investments wisely, it is difficult to assess the effectiveness of these workforce training programs. The toughest "litmus test" for the competence issue would be to design and manufacture a completely new weapon that meets its original military, cost, and schedule requirements. However, since the early 1990s, the United States has chosen not to replace its old weapons with new weapons and has done little in the way of major refurbishment of the old weapons.

Surveillance, dismantlement, and refurbishment of the legacy nuclear weapons stockpile since the end of the Cold War has provided some on-the-job training for some new members of the workforce. While these tasks can be technically challenging, in general, they are not perceived as such. They are often viewed by the technical community as caretaker or curator functions not requiring the highest caliber technical talent**.**

Since the mid-1990s, the NNSA has not been very successful in executing weapon surveillance, dismantlement, and life extension plan schedules. Recently, there has been improvement in weapon milestone performance—dismantlement in particular. However, it is not yet clear whether this is the result of increased management attention in the face of external criticism or fundamental corrections to operational practices that caused the problems in the first place.

In 5–10 years, very few mid-career technical staff and program managers will have substantive experience in the design, development, manufacture, and test of nuclear weapons. Yet, they are the ones that will have to execute the mission, train their successors, and, if deemed necessary, conduct testing. Today, there are fewer than two dozen designers who have participated in a nuclear test.

Experience

In the early 1990s, the U.S. nuclear weapons program changed in two fundamental ways. For the sake of argument, there were two main "reality checks" on program performance.

One reality check was **nuclear testing,** the final arbiter of whether the weapon design worked. This requirement invoked a high degree of technical discipline; failure at the Nevada Test Site would be painfully obvious. Nuclear testing and the moratorium invoked in 1992 received almost all of the notoriety and the attention of government at the end of the Cold War. The Stockpile Stewardship Program was born in 1993, and it focused heavily on improving computation and simulation capabilities to replace the need for nuclear testing. However, as a fraction of the total nuclear weapons complex workforce, relatively few technical people were engaged in the act of nuclear testing.

The other reality check was the continuous design, development, production, and surveillance cycle for new weapons—hereafter referred to as the **new weapon development cycle**. The vast majority of the technical people in the nuclear weapons complex were engaged in this cycle. While nuclear testing was supremely important, the vast majority of data collected to assess the quality of the weapons came from non-nuclear product acceptance testing at the production plants and surveillance testing throughout weapon life. Rigorous product testing provided continuous feedback on the competence of the people who designed and produced it. Knowledge and experience in weapons design is the keystone that supports decisions on all other the elements of the mission.

Decisions on how to resolve technical problems in production, surveillance, or dismantlement have to be rooted in a thorough understanding of the design.

Key capabilities necessary for conduct of the underground nuclear tests are not being maintained. The NPR of 2001 required that key underground testing capabilities be identified and exercised regularly on projects making use of these skills. Such projects and exercises are not being conducted. **On a positive note, the NNSA and its weapons laboratories have done an outstanding job in developing advanced computation and simulation tools** to compensate for the loss of nuclear testing. This is the prevailing political and technical judgment of the government-at-large, albeit in the absence of the reality check provided by nuclear testing. **The advanced computation and simulation tools are a magnet for attracting and retaining high caliber technical staff for this particular element of the SSP.**

On a negative note, the government-at-large has not come to grips with maintaining the competence of the majority of the workforce through hands-on experience gained via the new weapon development cycle. In the broadest sense, the best talent is usually drawn to what is new or cutting edge—it is what attracts, motivates, and retains them. Congressional authorization to go ahead with the RRW program would have been a meaningful step in this direction, but full-scale engineering development has not been approved and the RRW future is presently uncertain. Hence, the U.S. has chosen to rely on a nuclear weapon stockpile designed earlier and produced 20–30 years ago without providing the full-range of work experience needed to competently manage that stockpile.

The closest technical challenge to the new weapon development cycle is a major life extension program affecting an appreciable portion of the original weapon components and an appreciable number of weapons. The new weapon development cycle is only partially exercised in an LEP because only selected components are replaced by new design components or modified original components. Since the early 1990s, there have been only two major weapon LEPs. There was a nearly seven year gap between the end of new weapon production *circa* 1992 and the start of production on the first major LEP in 1999; and about another seven year gap to start production on the second major LEP in 2007. The work to follow the second major LEP is highly uncertain. **The inability to plan and execute a stable base workload makes it difficult to assure the continuity of work experience needed to maintain competency in such an arcane field.**

Creation of a stable base workload of design, development, and production is likely to be criticized in government circles unless it is an obvious reaction to a serious and immediate crisis. However, in the end, the government should understand that such a highly technical skill set is perishable without being exercised and that demonstrated competence is necessary as long as nuclear weapons exist.

While the lower limit on the magnitude of the stable base workload is certainly important, stability of the workload from year-to-year is as important to the issue of maintaining technical competence. High standards for basic educational qualifications and good training programs for new recruits are necessary, but not sufficient. If new-design nuclear weapons remain politically unacceptable, then at least there should be a continuous workload of refurbishment through major weapon life extension programs.

The capability-based infrastructure for nuclear weapons comes with a "high price of admission" due to its specialized technology and the inherent safety and security issues. Indirect costs to maintain the capability-based infrastructure have always been high. The unique capability cannot be abandoned and recreated based on how many weapons the government wants in any particular year—a longer range view has always been necessary. However, since the 1990s, DOE/NNSA indirect costs have grown substantially due to an ever-expanding compliance culture—for example, indirect costs associated with administrative, environment, safety, and security support functions. The support functions are important; however, with no applied cost/benefit analysis to control the generation of new, costly requirements, these expanding bureaucracies result in diminishing returns on investment and reduce the real weapons work and the mission competence of the agency.

One notable example about growth in indirect cost is the decision to compete the Los Alamos and Lawrence Livermore National Laboratory contracts in such a way as to increase indirect cost (award fees, taxes, and retirement plans) by a few hundred million dollars a year. While the government mandated these contracts be competed, Congress did not add this sum to the top line of the NNSA budget. Personnel working directly on weapons programs are being reduced to help bear this burden.

Chapter 5. Intelligence Expertise

Current intelligence challenges that address potential nuclear threats to the United States and assess WMD developments worldwide have evolved over the past decades and are increasing.

Decision-makers must have timely and credible assessments of the threat from WMDs that could threaten the United States, forces abroad, and/or friends and allies; a comprehensive global awareness of potential developments that could occur in the decades ahead; a determination of consequences of potential adversary actions; and an authoritative understanding of the effectiveness and implications of responsive U.S. targeting actions.

These intelligence-based assessments are essential underpinnings in the development of rationale for a comprehensive nuclear weapons policy that can and should result in determinations of force structure, potential developments, operations, sustainment, or a possible force reduction. Rationale for policy development depends upon understanding the possible roles of nuclear weapons in the hands of an adversary as well as identifying the options for countering the threat. This rationale must be intelligence-driven.

The intelligence challenges that face the United States in the coming decades include:

- Monitor the continued development and sustainment of nuclear weapons in Russia and China.
- Monitor the continued development of nuclear weapons and weapons-related technologies in Pakistan, India, and Israel.
- Monitor potential emerging threats of nuclear weapon developments in North Korea, Iran, and the rest of the world.
- Continue to assess the long-range strategic goals of friends and allies with respect to weapons of mass destruction.
- Identify the likelihood of "radiological" or "dirty" weapon development by any of the above parties.
- Assess the possibilities of proliferation of weapons technology, components, or systems from any of the developers of nuclear weapons to other nation states, third parties acting as "middle men," or terrorist groups.

- Monitor the development of delivery systems (*e.g.*, missiles, aircraft, and unconventional platforms) that could be used by any of the above for integrating a weapon system suitable for operation against the United States, friends, or allies.
- Characterize the damage potential of the use of projected nuclear weapon systems or radiological weapons by any of the above parties against assets of value to parties who threaten the United States.

The task force assessment is that there is a shortage of analysts experienced with nuclear weapons, an aging population available for technical reach back, and a lack of focus on the nuclear problem, as well as lack of access to information that may be available. These problems exist throughout the Intelligence Community.

Emphasis in the Intelligence Community since 2001 has shifted to "counterterrorism." However, National Counterterrorism Center (NCTC) analysts do not appear privy to all appropriate data that may be available within the U.S. Intelligence Community. **Further, the NCTC appears very thin on nuclear expertise,[18] the internal resources are not focused on nuclear related problems (*i.e.*, "nuclear" may be a sidebar to some other facet of an assessment), and there does not appear to be interest or incentive to keep qualified professionals in the nuclear terrorism area.** The NCTC has few nuclear weapons experienced analysts (most with less than two years of experience). There is a lack of sufficient nuclear expertise for effective assessment of how or if nuclear activities (technology development, component tests, or even subsystem development) in a nation state (including friends and allies) could be made available to terrorists or third parties who could supply terrorists.

The linkage between the National Intelligence Council (NIC) and NCTC within the Office of the Director of National Intelligence is unclear to the task force. With emphasis on counterproliferation and counterterrorism, the task force is concerned that the NIC may have insufficient nuclear expertise focused

18. "Nuclear expertise" is defined by the task force to consist of proficiency in those skills necessary to understand the fundamentals of nuclear weapon technology, design, development, and/or test as conducted within the U.S. weapons complex and in the development operations of U.S. allies. Specialized expertise in the assessment of former Soviet Union and People's Republic of China weapons developments is a desired proficiency. Understanding of techniques possible for the development of "dirty" or radiological weapons is also a desired component. Appreciation of the breadth and depth of technologies and disciplines that must be integrated to deploy an operational nuclear weapon system is essential.

on important nuclear activities in Russia and China. In some cases, such as the Peoples Republic of China, projections of warhead development and weapon system development appear to have been overstated over the years. The concern is that there may be adversary development that has gone unnoticed.

The residual NIC and Central Intelligence Agency nuclear expertise has been spread thin with concerns regarding developments or potential developments in North Korea and Iran. Nuclear development activities in Iraq were overstated. In addition to North Korea and Iran, other countries could be sources of nuclear weapon expertise and/or technologies for third parties. Intelligence community access to these activities is severely limited and the NIC nuclear expertise does not appear deep enough to address all of the possible avenues of proliferation.

The National Geospatial-Intelligence Agency (NGA) has the historic role of exploiting overhead data to monitor known threats and identify new threats associated with emerging developments in nation states or terrorist activities. However, NGA analysts on average have less than one year of experience and are stretched with global demands. As the 21st century unfolds, the need for global exploitation, rather than focusing only on the former major players becomes even more important. **The task force did not find sufficient nuclear expertise to identify and assess emerging developments.**

The Defense Intelligence Agency (DIA) directs and manages DOD intelligence collection requirements using human intelligence, measurement and signature intelligence, imagery intelligence, and signals intelligence. Emphasis in the organization has shifted following the Cold War and the 9/11 attacks to supporting the DOD efforts in the global war on terrorism and the DIA–operated Joint Intelligence Task Force for Combating Terrorism (JITF-CT). **The result is that the residual nuclear expertise within DIA (significantly reduced since the close of the Cold War) has been stretched over several competing priorities.**

Neither the NIC nor the Under Secretary of Defense for Intelligence (USD [I]) is monitoring the nuclear expertise skill base; has identified what is essential to monitor, assess, and analyze the global threats posed by nuclear developments; or has established a career development plan to assure that resident skills are available through the years in the cognizant agencies. Intelligence personnel in the Department of Energy do not appear to be directly involved across the board in assessing nuclear capabilities resident with current adversaries or in projecting capabilities that might be associated with terrorist groups. DOE/NNSA laboratories with relevant U.S. expertise do not

appear to be a routine component of threat assessment. Rather they support various elements of the Intelligence Community via "work for others" arrangements.

Importantly, work on nuclear components or devices is not the whole story. **The task force found little emphasis in the Intelligence Community on assessing the potential for integrating nuclear weapons with launch systems, carrier vehicles, or nonconventional delivery means to create potential nuclear weapon systems.** Expertise essential to assess those developments resides in the DOD program offices and agencies that have developed U.S. weapon systems over the years, but does not appear tied into the Intelligence Community assessments.

The intended applications of several suspected nuclear technology activities remain an unknown. Responsible intelligence agencies do not appear to address, in a consistent manner, the necessary relationships of nuclear weapon technology or component developments with potential delivery systems to create nuclear weapon systems. The result is that "the threat" has not been defined to the leadership in terms that can be readily understood—for example, a clear understanding of the possibility (probability) of a nation state or terrorist group having the capability to deliver a nuclear weapon on Washington D.C and when such a capability might exist.

The task force was briefed by a portion of the Intelligence Community (identified in the list of presentations at the close of this report) and was not provided personnel experience or demographic data with respect to nuclear skills expertise in those agencies. The significant body of the Intelligence Community that did not brief the task force obviously also represents an unknown regarding nuclear skill expertise. However, the information gained by the task force strongly suggests that focus on nuclear issues in depth has been reduced because of reductions in force and the increasing scope of the security challenge—moving from a Cold War single adversary to concerns regarding global threats in the decades to come.

In addition to understanding the threat, global awareness is also important. Assessments of the possibilities of potentially rapid development of nuclear weapons or components by other members of the industrial world are also needed.

There does not appear to be any study or assessment sponsored by DOD or the NIC that specifically addresses the potential roles of nuclear weapons in the 21st century. The task force is aware of some efforts that

address potential future scenarios (such as the DSB Task Force on Future Strategic Strike and the National Intelligence Council "2020 Project").

Classified "global awareness" assessments that identify the breadth of possible global nuclear weapon development options and address the likelihood of each do not appear to be a routine element of threat assessments. The task force is concerned that the resident nuclear expertise is not available within the Intelligence Community to produce assessments with credibility.

- **The task force also found that the United States lacks, and is not developing, sufficient skill in cultural understanding to adequately support U.S. deterrence goals, especially regarding nuclear weapons.** The diversity of post Cold War potential opponents and the relative lack of U.S. familiarity with critical factors that may be unique to their decision-making necessitates understanding of many cultural factors—such as deep-seated religious beliefs, perceptions, leadership, methodology for formulating decisions, and perceived degree of freedom. Additionally, the ability is lacking to articulate U. S. strategic concerns.[19]

Recent experiences support the task force conclusion of the need to develop skills in this area:

- In 1990–1991, the United States failed to understand Saddam Hussein's mistakenly disdainful perceptions of the United States, particularly his apparent belief that the United States would be unwilling to fight a war that could involve significant casualties.
- The United States failed to sufficiently understand the culture of Al Qaeda before September 11, 2001, and the draw of young (particularly Sunni) Arabs to Al Qaeda (and other insurgency groups) leading suicide missions while engaged in Iraq. Essentially, the United States misunderstood the impact on the Islamic sphere of having a western force involved in a land war in an Asian Moslem country.
- The U.S. declared a series of North Korean actions to be "unacceptable," including the testing of a nuclear weapon, only to see North Korea undertake those actions. Hence, "red lines" have appeared to be ineffective and willfully violated by North Korea. The end result indicates

19. This topic is addressed in detail in the recently published report of the *Defense Science Board Task Force on Strategic Communication*, January 2008.

> the need to understand when to establish deterrence red lines, how to communicate them credibly, and what actions to threaten and take in the event of their violation. The United States requires greater understanding of North Korean motives, values, and interests than has been available to this point.

The task force finds that the Intelligence Community has not moved past the Cold War paradigm of monitoring (from afar) to intrusive intelligence gathering, based in part on understanding the culture as well as, in this case, the nuclear expertise essential to produce new systems or radiological devices. Further, the task force finds little or no evidence of concern, as the 21st century unfolds, regarding the possibility of shifting alliances with the thousands of weapons already available or newly emerging nuclear states. Such assessments require a command of nuclear expertise that is not apparent as well as an understanding of values other cultures hold dear and may cause foreign leaders to act unexpectedly from a U.S. perspective.

The task force finds that damage assessments have not been conducted in the kind of rigorous or methodical fashion that can inform the leadership of possible vulnerabilities in the future. The task force is concerned that the skills, and in some cases the data base, to conduct such assessments do not currently exist in the appropriate agencies as a core element of the Intelligence Community so that the implications (consequences) of nuclear weapon developments by adversaries can be established with credibility.

Technology and personnel at the National Security Agency supporting STRATCOM operational weapon systems have aged. The technology should be upgraded. Importantly, the National Security Agency has difficulty attracting and retaining young personnel to work on these systems.

The expertise required to identify the threat and determine appropriate surveillance and reconnaissance measures that can be readily interpreted by analysts is thin, at best. Targeting depends on identifying the threat and on timely (and persistent) surveillance and reconnaissance. The good news is that assets continue to be developed that enhance the capabilities of the various ISR missions. However, the nuclear threat is now global, rather than confined, as it once was, to identifiable targets in the former Soviet Union. In addition, many ISR assets have multiple missions. Personnel using the systems (the operators) are subsequently stretched so that their nuclear skills are only tested a fraction of the time. The possibility of "missing something" appears to be significantly higher now than it was during the Cold War.

The design and development expertise that is essential to providing weapon-survivable systems (ICBMs, ballistic missile reentry systems, bombers, and cruise missiles and their offensive countermeasures) against nuclear threats has disappeared. For example, the vigorous efforts that the Air Force had in "preservation of location uncertainty" and concealment, camouflage, and deception were terminated. As mentioned in Chapter 3, the Air Force Weapons Laboratory no longer exists. On the other hand, the Navy continues efforts to ensure the integrity of the U.S. undersea security programs.

Design of components of the force structure required in response to threats and essential to counter an adversary depends upon credible, time-phased, intelligence projections of both the target structure and the capabilities of the potential adversary—including details, for example, of the characteristics of weapons that threaten the United States or its force structure. This "threat requirements" drive process has yielded to a "capabilities achievable" modus of operation partly because the intelligence data assessments available cannot support the rigor essential for system design requirements.

No U.S. development of offensive countermeasures against a missile defense threat has occurred since the early 1990s. In addition, the integrity of countermeasures currently designed for implementation on U.S. offensive forces, should the need occur, may well have been compromised by the proliferation of data made available to the current U.S. missile defense program. Those who developed offensive countermeasures for U.S. nuclear weapon systems are no longer involved. These skills are an important adjunct to the nuclear weapon system as they provide the basis for survivability in hostile environments.

Chapter 6. Military Competencies for U.S. Nuclear Weapons Operations

Recognition of the importance of the mission appears under-appreciated. There was a strong perception in the operational community that senior personnel (particularly Navy flag officers and Air Force general officers outside the immediate operational chain of command) do not frequently reinforce the importance of the nuclear mission. Officers in both the Navy and Air Force stated they get questions concerning mission importance from their subordinates.

The task force finds that senior leadership does not routinely participate in "war games" that address the employment of current or projected nuclear forces in scenarios that may be possible in the years ahead. "Exercises" are one of the means available to develop a coherent policy based upon achieving desired expectations—that is, a policy founded on intelligence projections and applications of force structure to assure that the results are attainable. Such exercises have the advantage of "testing" the components of the force (availability; reliability; survivability, including defense penetration; accuracy; and effectiveness) in flexible and/or time-urgent scenarios.

Some targeting objectives may clearly require nuclear weapons to achieve success or to "cap" the conflict at the lowest possible level of total force engagement. Intelligence has to identify what those targets may be. Importantly, "intelligence-based" exercises would reinforce the rationale for nuclear weapon systems at the senior leadership level. The task force finds that this compelling rationale based upon threat assessment has not been transmitted "top-down" across the commands and agencies. As a consequence, many of those in the ranks do not see the vision or understand the mission.

These exercises should include use of nuclear forces in a deterrent role to hold at risk an adversary's offensive weapons of mass destruction capabilities or, in a limited global strike, to achieve specific strategic objectives.

The task force finds that, absent periodic intelligence-based planning for countering WMD targets and/or using U.S. nuclear force components against targets that cannot be otherwise held at risk, the United States has limited available options. The task force has determined that, as a consequence, operators and implementers of U.S. nuclear forces are

disconnected from intelligence-based rationale and do not fully appreciate the imperatives and priorities once presumed for safety, security, surety, and operation.

The task force found that, in general, operators understand the importance of their nuclear deterrence responsibilities, appear well trained, supervised appropriately, and rigorously examined to determine their proficiency at reasonable intervals. However, a number of concerns were evident, as detailed below.

At STRATCOM, nuclear competence development and maintenance were not emphasized when broadening the command's mission and scope. The task force noted that the central contribution of U.S. nuclear forces to global strike and deterrence operations is dramatically downplayed in version 2.0 of the document produced by STRATCOM entitled, "Deterrence Operations Joint Operating Concept" (December 2006).

The STRATCOM mission assurance function in J3 and its mission-related inspector general functions have been eliminated. For several years prior to September 2007, the command did not monitor or become involved in the inspection results of field units. The senior STRATCOM representative who attended the recent Global Thunder planning conferences was a Lieutenant Colonel from J711 (Joint Security Exercises and Training Section). Until the recent incident at Minot Air Force Base concerning the unauthorized movement of weapons, it was reported that STRATCOM had not witnessed or directly assessed a Nuclear Surety Inspection or Nuclear Operational Readiness Inspection in the past five years.

For the strategic nuclear deterrence mission, nuclear reconnaissance planning is not adequate. STRATCOM has divested the billets necessary to conduct such planning. The dedicated internal capability to provide battle damage assessment no longer exists. The overall assessment capability of DIA for determining targets requiring a nuclear weapon response in support of STRATCOM appears thin. It was unclear to the STRATCOM personnel interviewed in July 2007, how JFCC-ISR (Joint Force Component Commander for Intelligence, Surveillance and Reconnaissance) fulfills the nuclear mission needs of STRATCOM. Additionally, Global Strike Integration (J2), in particular, indicated they lacked sufficient personnel to handle the command's nuclear intelligence requirements.

Command and control procedures are considered too complex by officers interviewed (both junior and senior), resulting in significant

numbers of exercise errors by Air Force and Navy personnel. Command and control training for the Navy Perspective Commanding Officer pipeline (particularly for those officers without prior SSBN experience) was considered weak. Some SSBN commanding officers have not previously served aboard an SSBN and have difficulty comprehending the process. The expanded use of the system for other missions contributes to the problem. It is not clear whether leadership is taking this problem seriously and instigating necessary corrective action.

In the area of nuclear weapons security, the services have a number of deficiencies that result in the need for waivers to the requirements of DOD 5210.41-M (*Nuclear Weapons Security Manual*). Many of these deficiencies are being mitigated by the application of manpower, rather than investment in equipment or technology. This contributes to a sense of frustration and the impression that nuclear matters are of low priority.

Low Nuclear Weapons Personnel Reliability Program (PRP) certification rates can exacerbate personnel pressures. It was reported at an Air Force unit that approximately 65 percent of Air Force security personnel achieve PRP certification. Some may not want to be certified and purposely avoid getting the certification. Commanders realize that certain weapon security positions do necessitate PRP certification. But at least one Wing Commander believes current PRP requirements are unrealistic and excessive for some security functions, deeming that only 100 out of 800 security personnel actually need PRP certification.

The Air Staff has few nuclear billets and no senior personnel directly focused on nuclear weapons or deterrence.

Nuclear alert was identified as a fragile skill within the bomber units of 8th AF. The last time the skill was practiced was in September 1992, more than 15 years ago. Insufficient time and attention is devoted to maintaining this expertise and reversing loss of this skill. Exercises do not sustain alert status. Stand-down occurs shortly after generation, far before sustained alert can be evaluated.

The amount of Air Force training for nuclear missions has been significantly reduced since 1992. Today, most of it is captured in the annual "Global Thunder" exercise that shares time with conventional missions as part of the 8–10 day deterrence exercise.

Bomber TF 204 (Strategic Bomber Aircraft task force reporting to STRATCOM) had 49 people in 1994. When it combined with TF 224 (Reconnaissance Aircraft) in 2003, it was believed that 12 additional billets would be moved into TF 204; however, only one billet was transferred into TF 204. Thus, the 26 people currently in TF 204 are short-handed and lack essential skills.

There is no longer an Air Force distinctive missile badge for personnel assigned to ICBM duties. The word "missile" does not appear in the title of "Space Command." There is no incentive pay and no credit given for "deployment-in-place" for officers and security personnel. Some U.S. Air Force personnel did not know the Air Force still had ground-based missiles on alert. The one month SPACE 300 course (Air Force space senior certification course) has only a few classroom hours on missile-related subjects.

At the time of our visit, the 526th ICBM System Wing was in a state of flux. This command of approximately 350 people is the sole supporting technical wing for operational ICBMs. The command had no active duty personnel experienced as ICBM operators, three ICBM missile maintenance personnel, and the incoming commanding officer (0-6) had no ICBM experience. The reporting chain of command was unresolved. The command has subsequently been downgraded to a Group reporting to Air Force Space and Missile Center.

The manning required to support ICBM modernization and overseas deployments is not factored into the overall Air Force requirements for the Minot 91st Space Wing security personnel. E5s are also undermanned, and officers leave the field after their first tour of duty. They only return, if ever, as a field-grade level officer. This rotation creates commanders who are not fully cognizant of their responsibilities and the operations they command.

Air Force commanders reported that they had no input into decisions concerning which personnel would be sent overseas resulting in manpower and talent loss at the nuclear weapons commands.

The SSBN missile technician community appeared to be under considerable stress. Training for this specialty, particularly maintenance training, was described as weak. Junior and senior missile technicians described A and C schools (basic and advanced training) as too computer-based and ineffective. Missile technician and FTB (fire control technician) rates were combined, and training reduced from 35 weeks to 23 weeks. Personnel perceive that nobody really fixes anything; instead they replace components. This leads to an overall decline in system knowledge.

The SSBN nuclear weapons security forces (USN and USMC) have two chains of command below the SWFPAC (Special Weapons Facility, Pacific) Commander. It was recommended by base personnel that the USMC Lieutenant Colonel be in command of all security forces to ensure unity of command and eliminate the "seam" between USN and USMC personnel. Further, it was reported that the relationship between the local/state law enforcement and base security required strengthening, and that the importance of the mission needs reinforcement to these outside communities.

The task force noted that the U.S. Army FA 52 (Nuclear Research and Operations) program remains an important source of nuclear expertise and retains its focus. The Army FA 52 community is widely respected for the weapons effects knowledge and intelligent application to the needs of the nuclear weapons community. No other service provides this skill.

We found that the core courses of instruction at the war colleges tended to treat nuclear deterrence strategy as a historical artifact or as a subordinate element of a broad and diffuse theory of deterrence and coercion. Minimum time in the core was devoted to developing a strategic understanding of the role for nuclear weapons.

Chapter 7. Weapons Effects

While mass destruction scenarios are unlikely, limited nuclear engagements may not be. Potential adversaries, both state and non-state, may consider that nuclear weapons are a viable warfighting capability to counter U.S. conventional superiority. In particular, the need is re-emerging not only to have an effective offensive nuclear deterrent, but also to take prudent measures to survive and operate in/through a nuclear environment.

Expertise for this aspect of nuclear military operations has resided historically in the nuclear weapons effects community, comprised of knowledgeable military operators and a skilled technical base in both the laboratories and industry. This task force was able to take advantage of the in-depth assessment of the nuclear weapons effects enterprise conducted by a parallel task force of the Defense Science Board and Threat Reduction Advisory Committee (TRAC).[20] Their principal findings with respect to skills are that:

- **General military knowledge about nuclear weapons effects, be it for planning offensive operations or, more significantly, for ensuring sustained conventional operations, should an adversary employ a nuclear weapon against us, is lacking through all the services and combatant commands.**
- **The technical community associated with nuclear weapon effects which is an essential element of U.S. offensive force development and operations has suffered from years of neglect. The capability that remains resides in a few small, largely isolated pockets in the Army, Navy SSP, U.S. Strategic Command, and the NNSA weapons laboratories.**

The principal goal of the nuclear weapons effects enterprise is to assure successful operations in a nuclear environment—whether that environment is generated by an adversary or by our own use of nuclear weapons. Success requires an intimate integration of technical and operational understanding of offensive and defensive nuclear weapon system availability, operability, survivability, and effectiveness in nuclear environments. These challenges have been long ignored. Given some notion of the range of threats, military operators,

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20. *Joint Defense Science Board/Threat Reduction Advisory Committee Task Force on The Nuclear Weapons Effects National Enterprise* (forthcoming).

supported by technical expertise, must then make trade-offs among various approaches to assure critical mission functionality. Those approaches could include hardening equipment, shielding personnel, interrupt and recovery, or redundancy in design of fielded units. Many consider the complexities of understanding and addressing nuclear weapons effects as difficult a challenge as the design and assurance of U.S. offensive and defense systems.

Principal skill sets important to a robust capability in nuclear weapons effects characterization and mitigation are in short supply.

- **Knowledgeable military operators and specialists**, within the services and combatant commands, able to determine and assess critical capabilities for survivability; develop tactics, techniques, and procedures (TTPs); train and exercise to these TTPs; and understand the collateral effects of U.S. employment of a nuclear weapon.
- **Assessment and evaluation expertise,** important as the bridge between the operational and technical communities, typically requires individuals with sound computational skills and a systems perspective that allows them to translate military requirements into technical guidance. Weapons effects expertise is essential in the design community resident in the services. The designers use the operational environment as guidance for developing systems and supporting information. The assessment and evaluation expertise also supports operators with tools, technical assessment, and characterization of radiation environments for gaming, exercises, and training.
- **Simulation testing and experimental capabilities** to create radiation environments that approximate single or combined environments of a nuclear explosion. The sophistication required to build, operate, maintain, and interpret the results from such simulators demands a highly technical set of specialized skills to apply the simulators for developmental testing, validate capabilities contributing to mission assurance, and support model validation.
- **Research and development** provides the technical foundation for the other three skill sets through the understanding of nuclear environments and the effects produced at a fundamental level, building and validating models to simulate the environments and effects on critical components and systems, translating results to design and operational guidance, and designing products to meet survivability standards.

Budgets support about 10 percent of the effort of the nuclear weapons effects community at its peak during the Cold War. The cessation of nuclear testing should force a much stronger reliance of any effects efforts on modeling and simulation, with the simulators assuming the role of model validation since none can replicate the environment created by a nuclear event. Yet no DOD investment has been made in model upgrades in nearly 15 years to take advantage of advances in computational capabilities that would in turn lead to higher fidelity predictions, and the DOE investment has been less than 5 percent of that made in yield calculations as part of the Stockpile Stewardship Program.

Nuclear weapon systems were developed by the services; *e.g.*, Air Force MMI, MMII, MMIII, MX, Small Missile ICBMs; Navy Polaris, Poseidon, Trident SLBMs; Air Force B-52, B-1, B-2 delivery platforms; Tomahawk, ACM, and ALCM for the services; Army Spartan and Sprint interceptors, Army Pershing Intermediate-Range Ballistic Missile, etc. The work force in industry supporting the service program offices exceeded ten thousand personnel with many having weapons effects responsibilities as the services, not the government labs, were charged with acquisition and deployment. Those capabilities are greatly diminished.

The remaining pockets of expertise are important to highlight, however, as they can provide the basis for rebuilding capability. They include the following examples:

- The U.S. Army Nuclear and Chemical Agency (USANCA) serves as the waiver authority on all Army systems with respect to nuclear survivability. Army processes, however, typically enlist USANCA review downstream of many program requirements decisions. The result is that it is sometimes practically difficult for the agency to impose survivability requirements if they are not already included.
- The Army has consolidated and reduced its simulator capabilities at White Sands. Capabilities are being maintained to support Army systems (and some other service needs) as part of White Sands' designation as a Major Range Test Facility.
- The Navy's SSP maintains its requirements for nuclear survivability and has a small, but capable, cadre of expertise in the contractor community.
- STRATCOM has renewed its attention to nuclear survivability by creating a survivability assessment group charged with periodic checks on how well the services are maintaining critical assets. The Missile Defense Agency has

recognized the need for survivable components in the ballistic missile aspect of its programs, by developing a standard and planning hardening.

- DTRA has stopped support for all its simulator facilities, but has provided the West Coast Facility's contractor operator the mechanism for full cost recovery from its users.
- DOE's NNSA has maintained a tech base through its Inertial Confinement Fusion program and supported applications development through its Survivability Campaign. That campaign, however, has come under intense congressional pressure in the last few years and has shrunk by a factor of ~3 to about $8 million per year. Overall, the DOE effort has declined by almost an order of magnitude from its peak, when effects testing was conducted at the Nevada Test Site.
- The EMP Commission has been successful in motivating actions to update DOD directives and standards, which in turn are leading the services to begin planning for testing critical equipment, but only for EMP.

Table 5, from the DSB-TRAC task force report, provides a "stop-light" assessment of the state of skills described above. The distinction between strategic and space forces versus conventional warfighting capabilities (general purpose forces (GPF), Global Information Grid (GIG), nuclear command and control (NCC), and critical infrastructure(CI)) is important because of the shift in adversary focus on the role they would envision for their nuclear weapons. **At much higher risk than in the Cold War are U.S. conventional forces, and the nation is unprepared to understand how serious these vulnerabilities might be.**

Table 5. Nuclear Weapons Effects Skills Assessments

Component Requirements	Assessment: GPF, GIG, NCC, CI	Assessment: Strategic and Space Forces
Knowledgeable operational military leaders, planners, and executors who are supported with products and services from rest of the enterprise	Shortage of knowledgeable operators; products and services not being used (**Red**)	Some knowledgeable operators, but shortfalls exist in many places (**Yellow/Green**)
Assessment and evaluation experts and their tools (environmental and prediction codes, etc.) supporting operators and developers	With limited exceptions, response unknown and mitigation options not formulated. Younger workforce learning in near isolation from operators (**Yellow/Red**)	Mix of aging and younger experts. Current tools inadequate for high confidence designs; large safety margins result. Aging expertise. (**Yellow/Red**)
Expertise and facilities for effects simulation to test equipment, experiment with new designs, and validate new codes	Used in a few cases; simulator shortfalls now in evidence (**Red**)	Simulator shortfalls now in evidence. (**Red**)
Science and technology (S&T) and research and development communities addressing new challenges, advancing fundamental knowledge, and tools used by all other components	Already small S&T program in decline (**Yellow/Red**)	Already small S&T program in decline—with exception of radiation hardening component efforts. (**Yellow/Red**)

Survivability requirements for fielded operational forces over the past 15 years have been ignored or systems not maintained to meet their original specifications. In the trade space of key performance parameters for new systems, nuclear survivability invariably falls off the list. Even in the cases of strategic forces, where standards have been maintained, those standards are based on Cold War criteria while potential exposure environments, and therefore hardening requirements, may be quite different. The task force also sees the evolution of joint operations that mix forces and levels of protection in a highly interconnected and interdependent way, so that even hardened forces may be unable to function because of reliance on unhardened components elsewhere in the system.

The decline in the military's level of nuclear expertise is more critical. Education and training for operations in nuclear environments has been low priority for so long that the vast majority of senior officers, let alone junior officers and enlisted personnel, have no knowledge of even the most basic facts related to nuclear effects. Service and joint exercises typically do not include adversary use of nuclear weapons, and the anecdotal cases where they do tend to force a reset by controllers because decision-makers do not know what to do. Career path specialists, outside of the Army's FA52s and some of the Navy's SSP cadre, are not valued.

DTRA's nuclear mission as the agent for the Joint Chiefs of Staff for nuclear site inspections and storage and safety preparedness retains its operational flavor but has shrunk in size considerably since the end of the Cold War. DTRA's nuclear mission for developing S&T tools for the warfighter and planner for nuclear targeting and consequence execution has shifted from an operational focus to a contracts-management focus. In this latter regard, there is a desire to move the agency back toward the development of technical career paths similar to the Naval Research Laboratory model. DTRA has not taken an initiative on developing expertise, similar to DOE's development of in-house expertise with programs such as RRW and test-readiness programs.

The contractor base that conducted assessment of implications (*e.g.*, damage and collateral effects) of adversary employment of a nuclear system against assets of the United States, U.S. forces abroad, friends, or allies in support of DOD and the services has withered away. Historically, weapon effects damage assessments of such attacks were conducted as part of red on blue exchange analyses and vice versa.

Chapter 8. Nuclear Threat Reduction and Emergency Response Capability

The national nuclear security enterprise has always extended beyond the areas of U.S. nuclear weapons and dealing with nuclear and conventional threats posed by peer competitors (mainly the former Soviet Union). It has also included non-proliferation, for example, and capabilities to respond to nuclear accidents. Since the end of the Cold War these "other areas" have increased in salience within the enterprise and have become more diverse. They now include non-proliferation; counter-proliferation; threat reduction (cooperative and not); dealing with nuclear terrorism; the nuclear aspects of "combating WMD"; and global protection, control, and accountability of nuclear weapons and materials. DOD and NNSA have strong roles in all of these areas.

The growth of these other areas within the national nuclear security enterprise has an important bearing on our subject—nuclear security skills and competences. Many of the skilled people who work in these other areas have come from the U.S. nuclear weapon program, and this continues to be the case today. But two problems are now created by the growth of the other nuclear areas. First, there is a larger need, in these other areas, for people who are trained in nuclear weapon skills. Yet the base of people with nuclear weapon skills is, at the same time, shrinking. Second, there is a potential competition, at the entry level, between these other areas and the U.S. nuclear weapon program for a limited skills pool being trained in universities.

On the other hand, the growth of these "other areas" of national nuclear security means that the total national nuclear security programmatic resources are larger, or at least are not shrinking as much as the nuclear weapon program. Hence, there is a larger total enterprise within which to support nuclear career paths, as well as the potential for skills-flow from these other areas into the U.S. nuclear weapon program.

This situation begs for a comprehensive skills-management effort within the overall national nuclear security enterprise, with explicit and defined responsibilities for managing that effort.

Responsibilities and programs in these broader aspects of the national nuclear security enterprise reside in many departments and agencies including the Departments of Energy, Defense, Homeland Security, and

State, the Nuclear Regulatory Commission (NRC), the Federal Bureau of Investigation, the Intelligence Community, and in state and local governments. This report focuses on DOD and NNSA, although it touches briefly on skills in other departments, and recognizes that managing the national nuclear skills pool is an important subject. The non-government base is also larger, including nongovernment organizations and companies that previously have not been involved in nuclear-related work. Sustaining and adapting the required skills is an important concern.[21]

Some of the skills required for these new missions and programs are not specifically nuclear. For example, response to nuclear accidents involves many of the organizational and operational skills needed for remediation of any large emergency. Non-proliferation diplomacy requires many of the skills related to diplomacy in general. These broader skill sets are not addressed here. But many of these general skills also have a nuclear dimension, and many specific nuclear skills are also required, including:

- knowledge of nuclear weapon design, including what is possible in the way of improvised nuclear devices
- ability to predict nuclear effects
- amelioration of the health effects of exposures to large doses of radiation
- ability to de-contaminate areas surrounding nuclear explosions or releases of nuclear materials
- passive detection of radiation from nuclear devices and materials
- active detection of nuclear explosives and materials, including accelerator technologies for radiography and stimulation of nuclear radiation
- nuclear explosive ordinance disposal and render-safe, including for improvised devices
- nuclear forensics, including ability to collect, analyze, and interpret debris from nuclear explosions
- nuclear intelligence
- nuclear material protection, control, and accounting

21. The NRC is responsible for incidents/emergencies in civil nuclear power. The skills resident in the NRC are not addressed in this report, though they are an important part of the national nuclear skills base.

- broad knowledge of how nuclear weapon development and production works, technically, programmatically, and institutionally, for possible future use in "elimination" of a nation's nuclear weapon enterprise

Most of the nuclear skills required in the areas listed above are generally similar to the skills required in the U.S. nuclear weapon programs in DOD and DOE/NNSA. But many of the specific skills needed are becoming increasingly specialized and not automatically provided by nuclear weapon skills. Four key organizations are focal points for the capabilities and skills needed: DTRA in the Department of Defense; DNDO in the Department of Homeland Security; NN-20 (Office of Nonproliferation Research and Engineering) in NNSA; and NCTC, addressed earlier in this report. The task force discussed nuclear skills with representatives of these agencies.

On the whole, nuclear skills to support these other aspects of the national nuclear security enterprise appear to be adequate but fragile, with the exception of a few specific skills (such as in intelligence) that are seriously at risk. The agencies with responsibilities for advocacy of the skills base are doing a reasonable job of addressing the concerns and indeed are taking steps to broaden and deepen the pool available, but it will be an uphill fight.

Specific shortfalls identified during the course of the task force deliberations include the following:

- Nuclear chemistry skills, including forensics analysis, are in dire straits, owing to the cessation of nuclear testing and the general decline in the U.S. nuclear power technology base. NNSA, DTRA, and DHS are taking corrective steps, but it will take some time.
- Nuclear event response training for state and local first responders and for personnel in the Federal Emergency Management Agency and Customs and Border Patrol.
- AFRRI (Armed Forces Radiation and Radiobiology Institute) has a small cadre skilled in special treatments for amelioration of the health effects of exposures to large doses of radiation. But public health organizations need to train more such people. AFRRI may need to expand its cadre to help.
- To assist civil authorities, more DOD personnel probably need to be trained in consequence management skills, including fallout mapping effects estimation.

- In DHS, certain nuclear skills need to be developed in organizations such as Customs and Border Protection where there has previously been little or no requirement. The same is true for state and local governments, including first responders. DNDO is the advocate in DHS for nuclear skill development, including state and local, but the task force did not interact with these other organizations and, thus, cannot judge the effectiveness of DNDO's advocacy.
- Nuclear skills required to support military operations fall into two categories. The first is DOD support to civil authorities for domestic emergency response. U.S. Northern Command has responsibility for this support and for advocating necessary training in the services with OSD oversight by the Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs. The second category is overseas military operations for defense against nuclear terrorism attacks and for nuclear capability elimination operations.
  - Programs and operational concepts for large-scale interdiction operations are barely beginning to emerge in DOD. Absent such plans and concepts of operation, it is premature to attempt any assessment of required skills or skills gaps.
  - For elimination operations, DTRA, U.S. Strategic Command, and the Army have worked together to stand up the 20th Support Command Headquarters element and planning is underway to develop a fuller operational capability, including tables of organization and equipment. However, many of these capabilities are growing out of the services' expertise in chemical and biological defense. The task force is concerned that not enough attention is being paid to the nuclear threat (including radiological) since the end of the Cold War.
- First responders are components of the National Guard. It was reported that the resident expertise across the continental United States was extremely thin among those units that would likely see action in the early moments of a crisis.

Recommendations for management actions needed to bring about improvement in the skills in this area are generally similar to recommendations for strengthening nuclear skills across the board, which are discussed elsewhere in this report.

The leadership of DTRA, DNDO, and NNSA are quite focused on the problem of skill-development and retention in the areas addressed in this

section. All three have programs with universities to expand the number of scientists and engineers being trained in the requisite areas. Intergovernmental Personnel Act and direct hires from the national laboratories are an important source of skilled personnel.

Chapter 9. Reorganizations and Staff Reductions

Over the past 15 years, the U.S. nuclear arsenal has been significantly reduced in size, in both numbers and types of weapons, while nuclear delivery systems have been reduced by a lower percentage. High-level statements of national nuclear policy, while rare, continue to note the important role of nuclear deterrence, and assert that as long as the nation retains nuclear weapons, their safety, security, and reliability must be assured.

Despite these statements, the task force finds the principal organizations responsible for all aspects of DOD's policy, oversight, and management of nuclear weapons have declined. The decline can be seen in dramatically reduced size, organizational focus diluted with additional missions, and subordination of the organizations deeper into their respective bureaucracies. Simultaneously, the rank and stature of the personnel who manage these activities have also been reduced significantly. Organizations responsible for policy, planning, research, development, safety, security, and operations have all experienced such change.

Table 6, taken from the recent DSB *Report on the Unauthorized Movement of Nuclear Weapons*, demonstrates the reduction in rank of those responsible for nuclear deterrence-related functions.

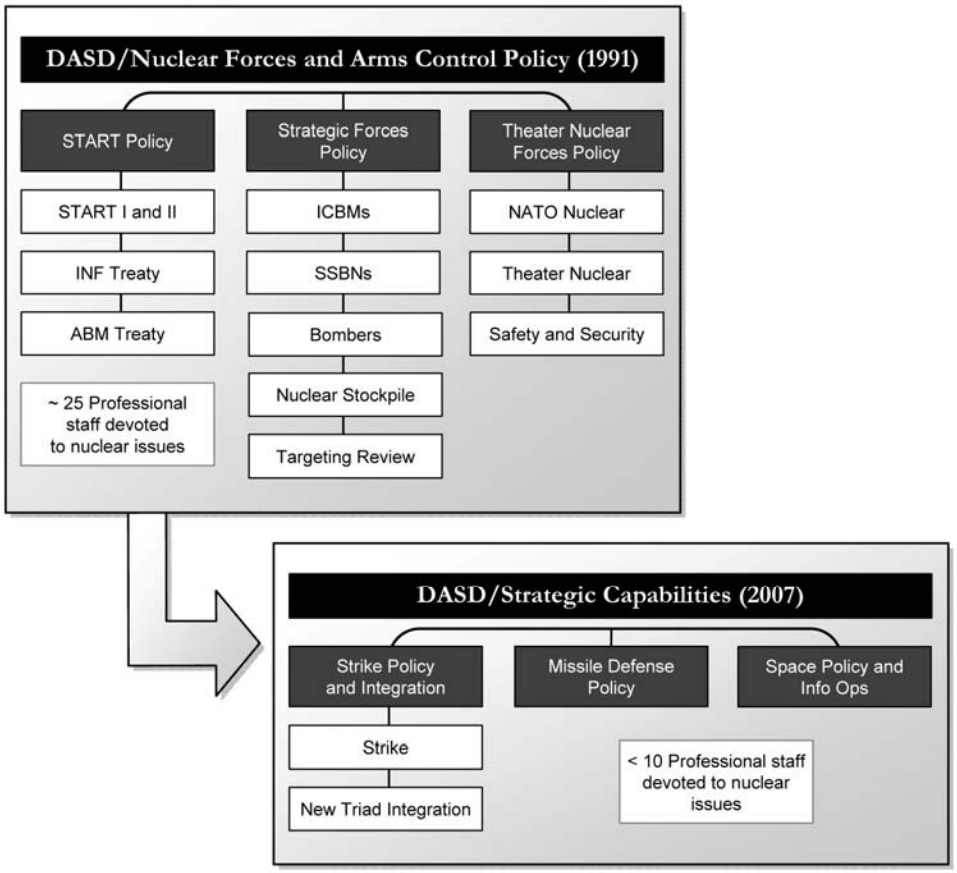
Figures 3 through 10 are examples of how, organization by organization, nuclear functions have been diminished and their management relegated deeper into the organizations to which they belong.

Table 6. Change in Level of Primary Focus

Organization	1990	2007
Secretary of Defense	Assistant to the Secretary of Defense (ATSD) for Atomic Energy—direct report for safety and security (Senate-confirmed appointee)	Deputy ATSD Nuclear Matters (SES) with multi-mission ATSD reporting to USD (AT&L)
OSD/Policy	Deputy Assistant Secretary for Nuclear Forces and Arms Control (SES)	Director, Strike Policy Integration (GS-15)
Navy Staff	Director, Strategy and Policy N51 (O-7)	Head, Global Strike & Nuclear Policy (GS-15)
Joint Staff	Deputy Director, Operations (O-8)	Chief, Strategic Operations Division (O-6)
Air Staff	Deputy Director, Forces (O-8)	Chief, Nuclear Operations Division (O-6)
Combatant Command	Commander, U.S. Strategic Air Command* (4 Star)	Chief, Division (O-6)
Major Air Command	Commander, Air Force Strategic Air Command* (4 Star)	Chief, Strategic Operations Division (O-6)
Numbered Air Force Bomber Commands	Commander, 8th Air Force (3 Star)	Commander, 8th Air Force (multi-hatted, multi-mission) (3 Star)

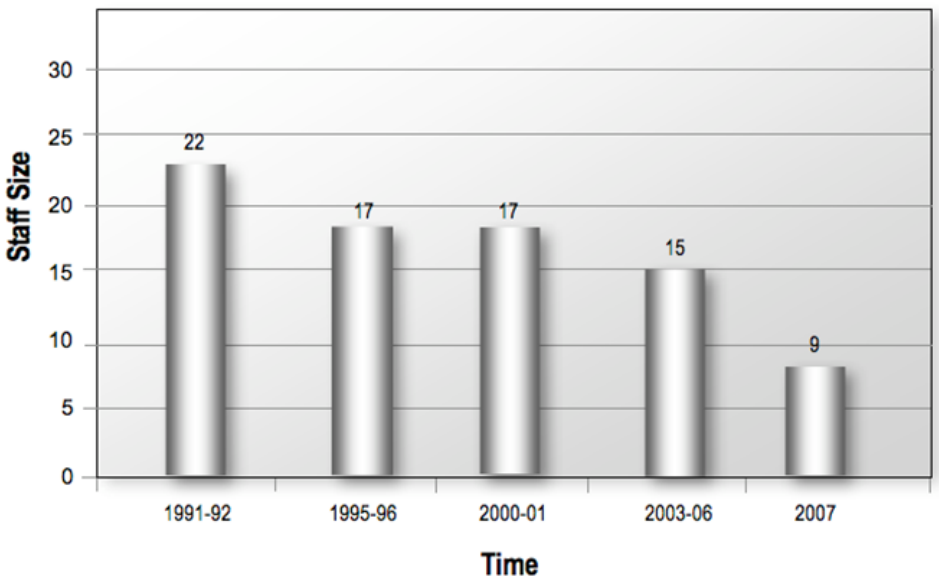
* Commander and Staff dual-hatted as Air Force Major Command and Combatant Command

Office of the Under Secretary of Defense for Policy



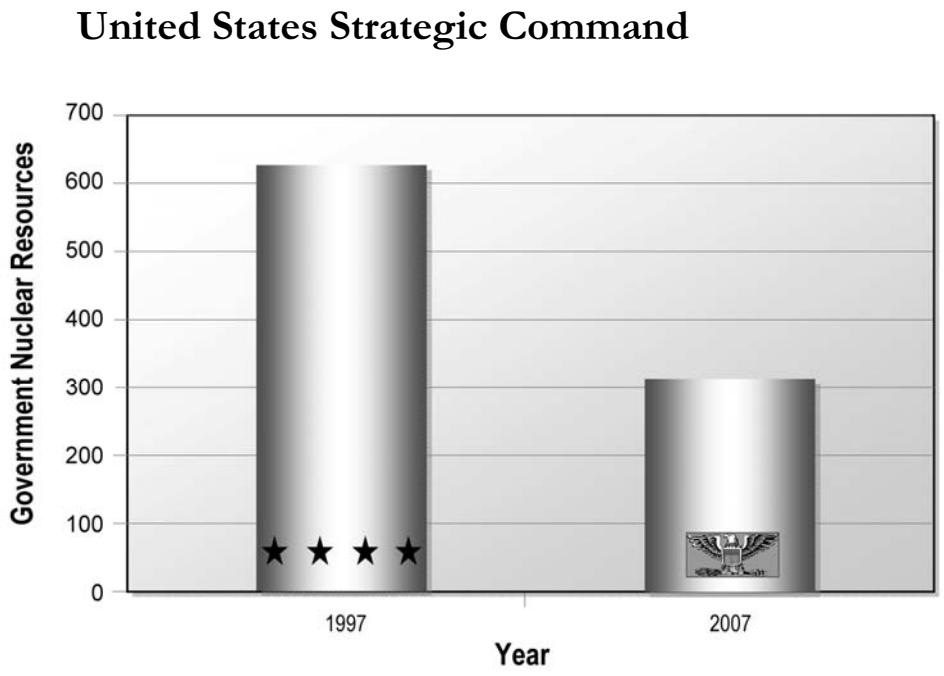
Source: The Evolution of OSD Nuclear Policy Organizations, 1991-2007

Figure 3. Office of the Under Secretary of Defense for Policy, 1991 and 2007



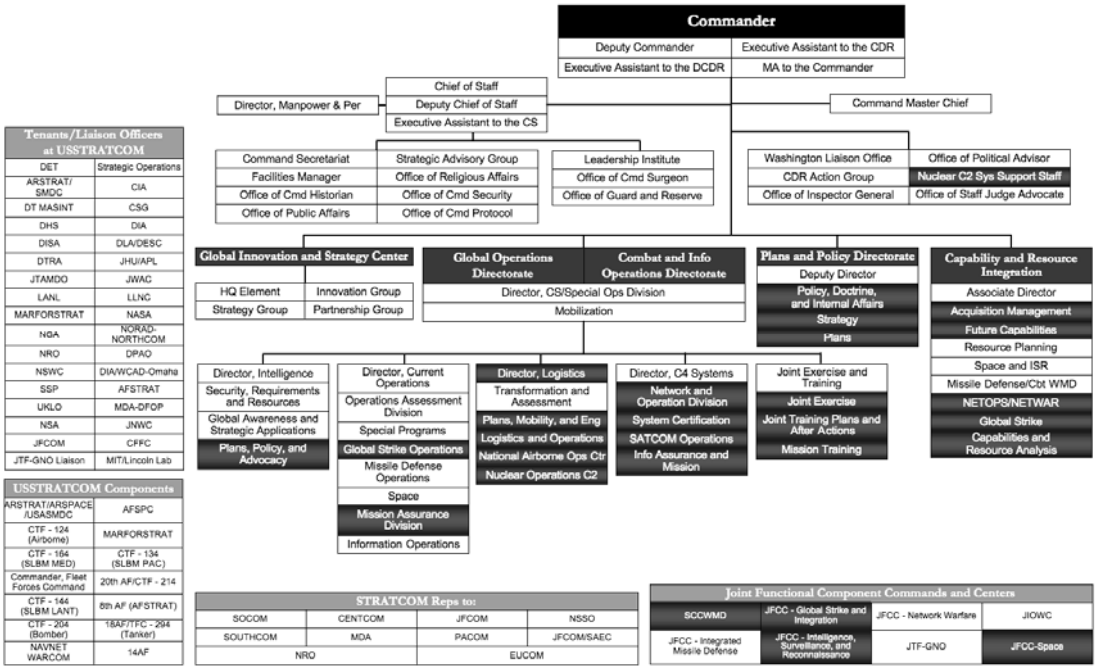
Source: The Evolution of OSD Nuclear Policy Organizations, 1991-2007

Figure 4. Size of OSD Policy Staff Devoted to Nuclear Issues



Source: U.S. Strategic Command

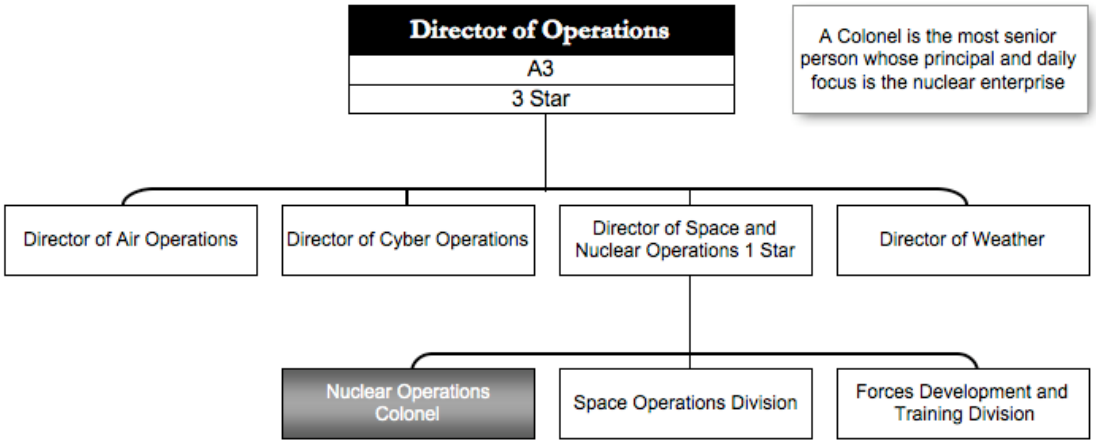
Figure 5. Resource Devoted to Nuclear Issues, 2002 and 2007



Source: Global Fortress Final Report, December 2007

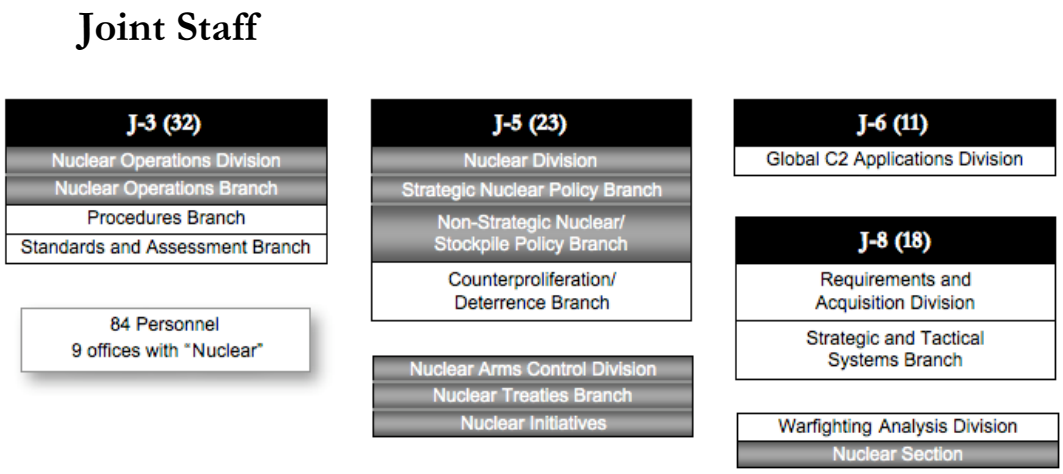
Figure 6. U.S. Strategic Command Organization

U.S. Air Force



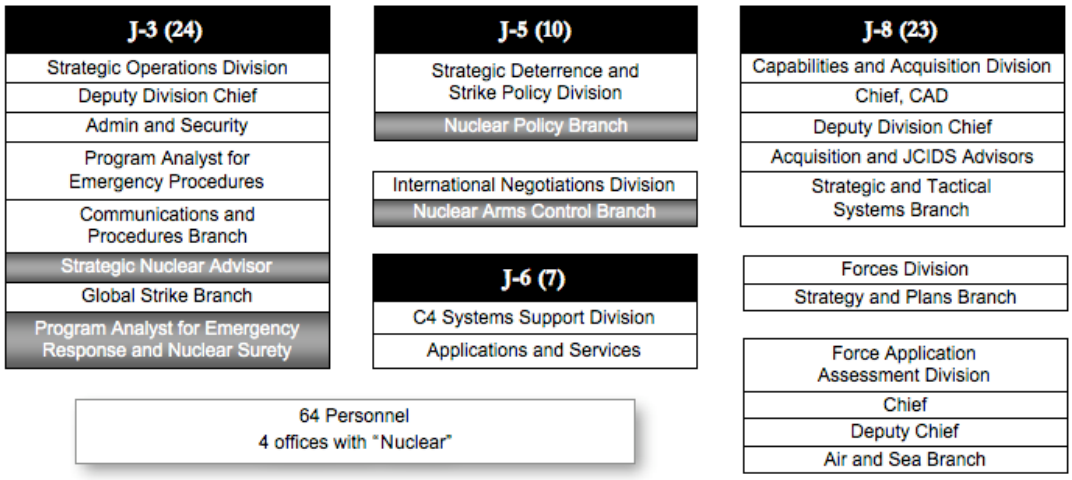
Source: The Defense Science Board Task Force on Nuclear Weapons Surety. *Report on the Unauthorized Movement of Nuclear Weapons*, February 2008

Figure 7. Air Staff Air 3 Operations



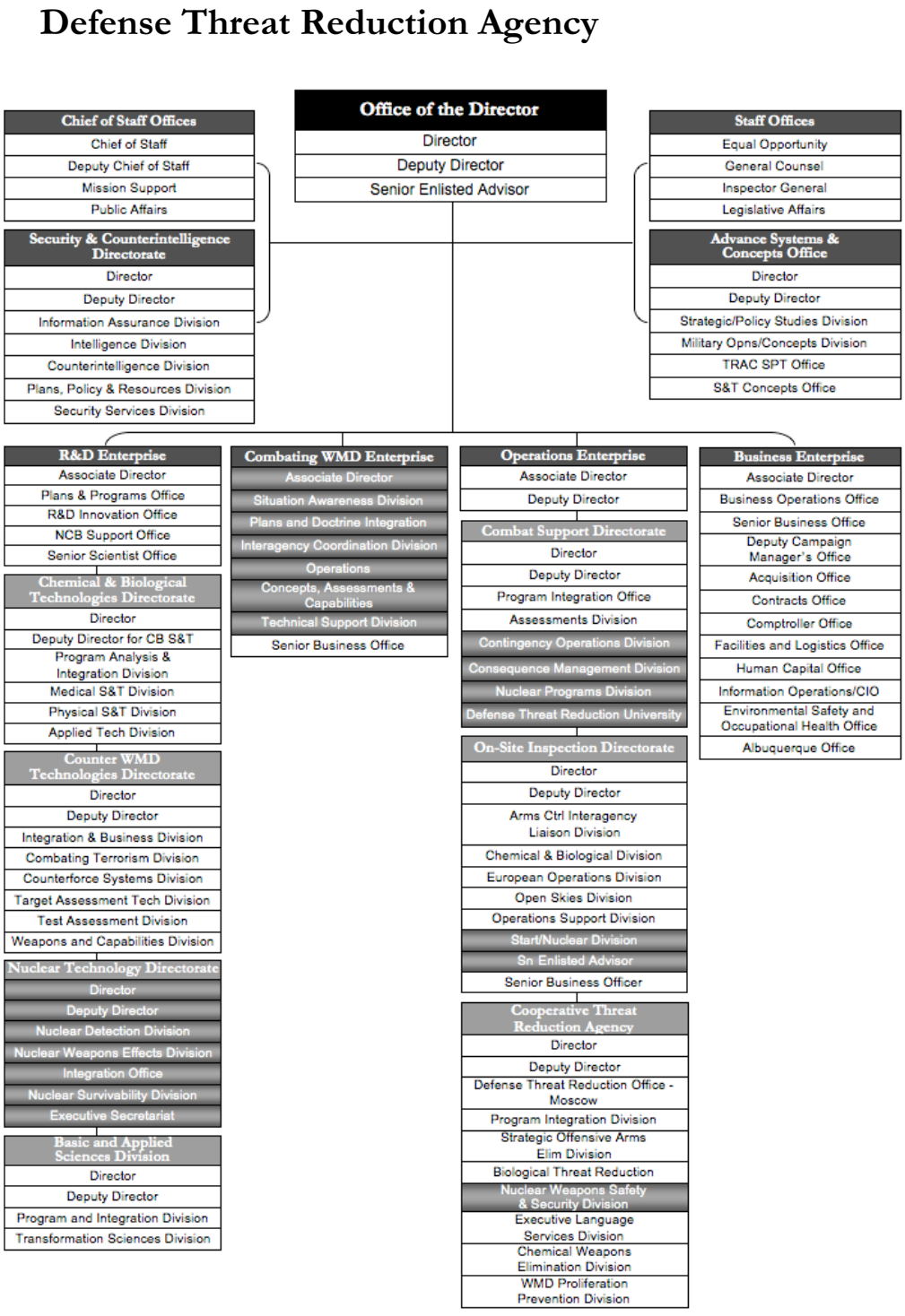
Source: "Nuclear Deterrence Skills" briefing to DSB task force, Joint Staff, February 1, 2007

Figure 8. Joint Staff, October 2001



Source: "Nuclear Deterrence Skills" briefing to DSB task force, Joint Staff, February 1, 2007.

Figure 9. Joint Staff, October 2006



Source: DTRA

Figure 10. Defense Threat Reduction Agency Organization (as of March 2008)

The corrosive effects of the example organizational changes noted, along with others, have sent the message that nuclear matters in 2008 are relatively unimportant compared to 18 years ago and that taking a position in the nuclear component of these organizations is not career enhancing. The reduction in career opportunities and nuclear weapons experience means that those in nuclear-related organizations today have less experience than those of comparable responsibilities in past decades. While not necessarily obvious today, future crises may result from reduced command attention, less effective training, and inexperience. The July 2007 weapon movement incident at Minot Air Force Base is such an example.

Chapter 10. Personnel Management

Although the 1999 Commission warned of adverse aging trends in the nuclear workforce nearly ten years ago, there is no evidence that the needed long-term strategy and planning for sustaining critical weapons expertise and transitioning expertise to a new generation of experts is taking place in either the DOE or DOD. This task force observed the following in our review of the government's management of civilian and DOE contractor personnel.

- Despite DOE's planned responses to the first 1999 Commission report, the DOE and DOD civilian workforce has continued to grow older.
- The DOE and DOD civilian workforce is old relative to the U.S. workforce.
  - The laboratory weapons contractors are old relative to the U.S. population of scientists and engineers.
- The percent of the DOE workforce eligible to retire has grown since the 1999 Commission report, and a large majority will be retirement eligible over the next 10 years.
- DOE facilities report they are satisfactorily meeting their current hiring target.
  - They have, and are using, a variety of tools to recruit and hire.
- Recent DOE hiring rates are a mere trickle when compared to the pool of eligible retirees in the DOE facilities, and the rate at which people could retire in the next ten years.
  - Once eligible retirees begin to leave in large numbers, the weapons program will need to shrink or hiring and training will need to expand dramatically.
  - Only NNSA and Sandia hired more than they lost over 2005–2007.
- Accelerated future hiring will be running against the tide of falling production of U.S.–citizen advanced graduates in science and engineering.
  - Weapons programs will need to compete in this shrinking pool.

An Aging Nuclear Weapons Workforce

The 1999 Commission on nuclear expertise expressed concern over an aging DOE weapons complex workforce. At that time, 34 percent of employees with critical skills were over the age of 50. Today, 40 percent of DOE laboratory essential workers are over 50. More than 45 percent of DOE weapons plant workers are over 50. Projections provided to the DSB task force indicate the proportion of workers in the older age brackets, and eligible for retirement, will grow at an accelerated pace over the next decade. The situation within the DOD civilian workforce is equally troublesome: 57 percent of DTRA essential nuclear employees are over 50, and 46 percent of the Navy's SSP essential employees are over 50.

The overall pattern observed reflects the growth of the communities responsible for nuclear deterrence in the 1980s, followed by a decade of decline in the 1990s. Someone who joined the weapons program at age 35 in 1985 would today be 58. The continued aging of this large cohort of the nuclear workforce poses strategic challenges for maintaining and transferring critical nuclear deterrence skills to a new generation.

The DOE Weapons Complex Workforce

The nuclear weapons workforce shrank significantly during the 1990s as a consequence of the reduced workload following the end of the Cold War. Weapons program contractors shrank about 50 percent (from 51,000 reported for 1992 to about 25,000 in 2000). Since 2000, the weapons program has gained somewhat clearer purpose and greater stability, nevertheless, the weapons program workforce has continued to shrink, falling an additional 20 percent to a total of about 20,000 in 2007.

Of this 20,000 weapons program employees in 2007, there were 12,759 who are declared to possess essential weapons program skills. The demographic data summarized here focus on this population of essential-skilled employees. (Appendix A contains detailed data on the DOE and DOD nuclear workforces.)

The 1999 Commission concluded that the weapons complex workforce was substantially older than the overall U.S. workforce in large measure because of the restrictions on hiring and workforce management practices in the 1990s. In the ensuing years, despite greater workforce stability and the acknowledged need by DOE to reverse the aging of the weapons workforce, the weapons complex workforce has continued to shift toward the older age brackets. Figure 11

compares the age profile of the nuclear laboratories and plants in 2007 with the age profile reported by DOE in 2000.[22]

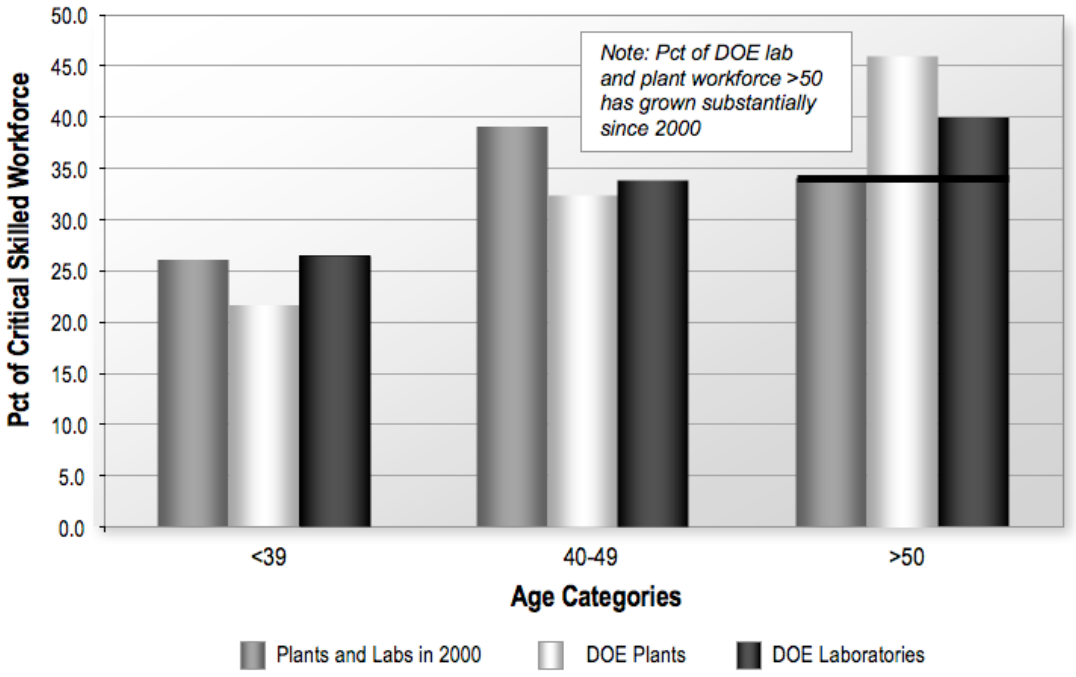
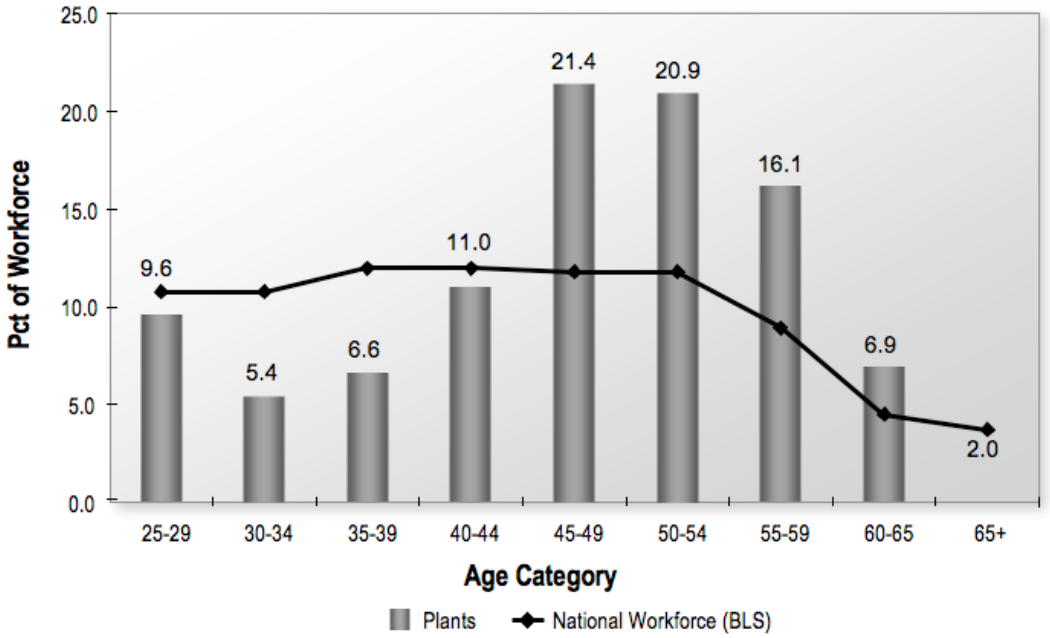


Figure 11. Demographics in the Department of Energy Plants and Laboratories, 2000 and 2007

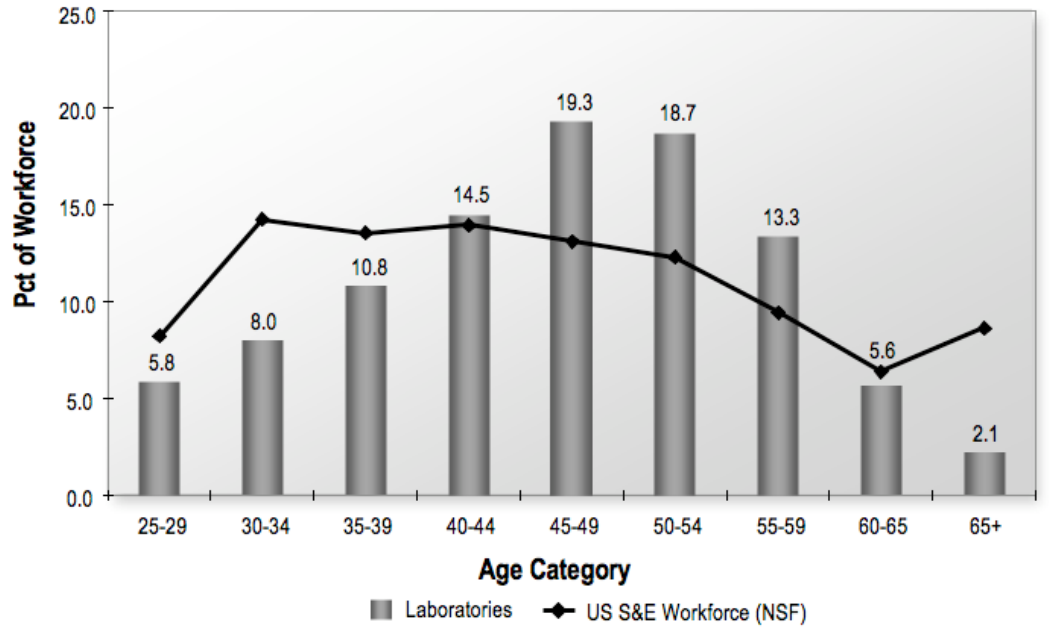
The comparison of national employment patterns in 2007 against those of the DOE weapons laboratory and plant workforce demographics shows that both the labs and the plants have a disproportionate fraction of their workforces in the 45 to 60 year-old age categories, relative to national patterns, and both are substantially under-represented in the age groups under 40 (Figures 12 and 13).

22. DOE and DOD response to the 1999 Commission Report, 2000.



Note: Plants report there are 5,851 employees with essential skills.

Figure 12. DOE Weapons Plant Demographics



Note: Laboratories report there are 6,908 employees with essential skills.

Figure 13. Weapons Laboratory Demographics

The DOD Civilian Workforce

The major DOD civilian elements include OSD, DTRA, the Navy's SSP, and several Air Force nuclear activities in Albuquerque (defense contractors were not surveyed). Their demographic patterns parallel those described above for the DOE workforce (Table 7). Indeed, the fraction of the workforce in the over-50 age groups in DTRA and SSP exceed those in the DOE weapons complex. SWFPAC has a younger workforce, but is still old in comparison with the national workforce. These DOD organizations have large numbers who are currently eligible to retire, with substantial growth in the fraction of the workforce eligible to retire by 2012.

Table 7. DOD Civilian Workforce Demographics (Percent by Age Group)

	<30	31-40	41-50	51-60	60+
DTRA	0	4	39	41	16
SSP	7	11	35	34	12
SWFPAC	12	13	39	31	5

One noteworthy difference between the DOD civilian workforce and the situation described above for DOE is that these DOD organizations have historically hired significant numbers of retired military personnel. This practice has long dictated that a substantial fraction of their employees would be retired military in their forties and fifties. These organizations will continue to rely on a flow of well-trained retired military personnel.

Retirement Eligibility and Turnover in the DOE Weapons Complex

In 2007, about 4,000 essential employees in the DOE plants and laboratories (30 percent of essential employees) were eligible to retire. Figure 14 shows that this represents a substantial increase for most facilities since 2000. The portion of the workforce eligible to retire ranges from 21 percent at Sandia and Pantex to over 45 percent for Lawrence Livermore. By 2012, the facilities project that 7,000 essential employees will be eligible to retire (53 percent of 2007 essential employees). At Lawrence Livermore and Kansas City plants, and Los Alamos, the fractions range from 55 percent upwards to nearly 70 percent. (Projections suggest that two-thirds to four-fifths of the workforce will be eligible to retire by 2017.)

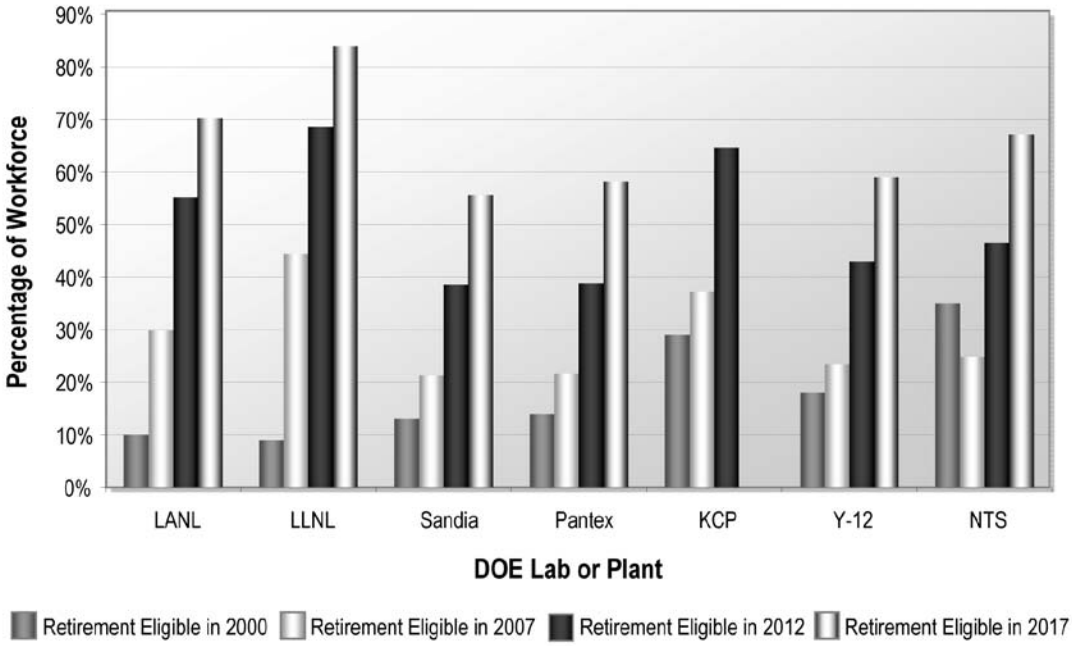


Figure 14. DOE Critical Skilled Workforce Eligible to Retire, 2000, 2007, 2012, and 2017

The impending demographic challenges have been masked to a large degree by the willingness of the current generation of employees to remain working even after they become eligible for retirement. Because of this behavior, the current aging generation will continue to support the complex for some years to come. Recent data confirm that only a small fraction of weapons program employees are retiring when they become eligible for retirement. Over the period 2005–2007, an average of just under 1,000 employees left the weapons complex each year. The percentage of departures from the plants and laboratories for *all* reasons ranged between only 6 percent and 24 percent of the pool of employees eligible to retire. These individual decisions to remain working have, of course, contributed to the substantial increase in the pool of retirement eligible employees across the weapons complex.

This behavior is not unique to the weapons program. The practice of delaying retirement within the technical workforce is consistent with the pattern observed nationally for scientists and engineers. For example, the National

Science Foundation data show that half of all PhD-level scientists and engineers are still working at age 70.[23]

Recruitment Tools and Experience

During the last three years (2005–2007) the DOE laboratories and plants hired an average of 600 essential employees per year. The percentage of hires ranged from zero for the Nevada Test Site up to 10.7 percent for the Sandia Laboratories, with most facilities in the range of 2 to 4 percent per year.

Table 8. DOE Lab and Plant Essential Employees Hiring and Departures (Averages for 2005–2007)

	LANL	LLNL	SNL	Pantex	KCP	Y-12	NTS
Hires	3.1%	2.2%	10.7%	2.8%	4.0%	7.4%	0.0%
Departures	5.5%	2.9%	4.0%	1.8%	9.0%	4.1%	1.7%

In contrast to the period of large-scale downsizing in the 1990s, when the 1999 Commission reported on the weaknesses in recruitment and hiring efforts, the weapons plants and labs now have active, ongoing recruitment programs. Generally, the DOE facilities reported that they are able to meet their near-term hiring targets. Appendix A describes the recruitment and retention tools employed by the weapons facilities to attract and retain employees. Hence, the weapons complex has a foundation on which to build in establishing the strategies that will be needed to recruit and train the new generation of weapons program employees.

The Competitive Marketplace for Technical Talent

Although the collapse of the dot.com bubble has somewhat cooled the market for science and engineering talent relative to the 1990s, the market remains quite strong. The U.S. economy continues to generate substantial rates of growth in high technology jobs. Real wages (inflation adjusted) continue to grow, albeit at a slower pace than during the late 1990s. One measure of the strong market conditions in 2006 is the very low rate of unemployment of individuals with PhD degrees in science and engineering. In chemical, electrical,

23. National Science Foundations, *Science and Engineering Indicators 2008*, Chapter 3: Science and Engineering Workforce, Table 3-22. Half are still employed full-time at age 66.

and mechanical engineering the rate ranged from 0.3 to 3.0 percent. In mathematics the rate was 0.7 percent, while in physical sciences it was 1.9 percent.

Trends in U.S. education of scientists and engineers imply continued flat or slightly decreasing supplies of new graduates within the fields of interest. The current *total* hiring of the nuclear weapons complex has been about 600 employees per year. Of this, the labs have hired an average of 316 employees per year. National Science Foundation data show that the U.S. is graduating about 3,800 U.S. citizens with new PhD degrees in the physical sciences, mathematics, and engineering each year. About 18,000 U.S. citizens receive MS degrees in engineering each year. The hiring that will be necessary to build the next generation of weapons stewards will require the ability to attract a small, but not insignificant, fraction of the national talent pool. The laboratories and production facilities must be armed to recruit their necessary share of the best available talent in what continues to be a highly competitive labor market.

DOE and DOD will need to take the steps necessary to compete for premier talent in the available national talent pool. Therefore, the tools available to the weapons facilities to recruit needed talent must be considered an essential element of the overall strategy for building the next generation nuclear deterrence workforce.

Chapter 11. Recommendations

As the previous chapters have detailed, the nation lacks both a comprehensive strategy and programs to identify needed nuclear deterrence capabilities, envision and implement the transformation from today's force to that future vision, and fill current and emerging competency gaps that are not sustained by ongoing programs. Given the general sense that the future may hold further reductions in the nuclear weapons stockpile, pressure to further reduce costs and infrastructure, and the aging of the community with special nuclear skills, the way ahead to a sustainable, appropriately-sized, and healthy nuclear skills community requires the development of a re-focused and expanded framework, combined with appropriate management and coordination across the community. Accordingly, the following recommendations are submitted.

Leadership

1. **The Secretary of Defense, working with the Secretaries of State, Energy, and Homeland Security and the Director of National Intelligence, must lead the development of a clear U.S. vision and strategy for nuclear deterrence capabilities and competencies.**

   - A new vision is required of what comprises needed nuclear deterrence capabilities and competencies and how to sustain them.

   - The strategy should address 21st century nuclear deterrence capabilities needed to respond to an uncertain future while supporting the broadly held goal of reduced reliance on nuclear weapons.

   - Advocacy within the administration requires a comprehensive framework and a widely shared and understood set of concepts for dealing with the national security issues raised by nuclear weapons across the board—American nuclear weapons and their role in deterrence, nuclear weapons and materials in the hands of states, nuclear terrorism, nuclear proliferation, and global/regional nuclear threat reduction.

2. **Senior civilian and military leaders should reinforce the necessity for and value to the nation of the nuclear deterrence mission.**

   - The administration and senior military leadership, through actions and words, should make a concerted and continuing effort to convey to the

nuclear weapons community that their mission is vital to the security of the nation and will remain vital well beyond the planning horizons normally associated with programmatic decisions.

3. **Commander, U.S. Strategic Command, should strengthen the headquarters supervision and involvement in the nuclear weapons program.**

   - The STRATCOM Commander, Gen Chilton, has initiated corrective action in this regard.

4. **Air Force and U.S. Strategic Command leadership should restore the rigor and focus necessary to reestablish and sustain the demanding proficiency necessary for nuclear operations.**

   - Commanders must plan, integrate, fund, and staff commands to ensure effective skills for mission success at all levels.

   - Unresolved waivers of security and other requirements should have corrective actions planned and funded.

   - Nuclear bomber alert should be exercised and adequate training incorporated as necessary.

   - Personnel Reliability Program should be reviewed to ensure realistic requirements.

5. **The Administrator of NNSA must reduce the high indirect costs of the nuclear weapon complex. These high costs impede refurbishment of legacy weapons, or authorization of new weapons if proposed, and preclude the work experience needed to maintain competence.**

   - The NNSA laboratories and production facilities must be incentivized to reduce indirect costs to make more affordable efforts to sustain and enhance the skills needed to respond to today's threats and future challenges. Many of the causes of these high indirect costs fall outside the control of the Administrator, but he can, working with the Secretary of Energy and Congress, move to address this increasingly burdensome issue.

Organization

6. **The Secretary of Defense should assure that nuclear weapon systems related responsibilities in OSD are at the proper level and are adequately staffed.**

   - Create an Assistant Secretary of Defense for Strategic Weapons as previously recommended by the DSB Permanent Task Force on Nuclear Weapons Surety.

   - Elevate nuclear weapon responsibilities within the Office of the Under Secretary of Defense for Policy to the level of Deputy Under Secretary to ensure high-level attention is focused on development of a national nuclear weapon strategy and to ensure that issues affecting the deterrence and defense posture of the United States are provided appropriate evaluation.

   - Reestablish OSD study and analytic capabilities for nuclear deterrence to support senior decision-makers.

Strategic Planning

7. **The Secretary of Defense should establish nuclear requirements for capabilities, including nuclear competencies, force structure, and programs for the timeframe 2009 to 2030, using the next Nuclear Posture Review, and provide requirements for NNSA planning.**

   - Evaluate the U.S. nuclear weapon capabilities needed as hedges against the uncertain future.

   - Included in this effort as part of the NPR, evaluate the technical feasibility and cost aspects of adding nuclear capability to platforms developed for conventional weapon delivery.

8. **The Secretaries of Defense and Energy, with the Director of National Intelligence, should urgently identify and act to fill the gaps in the skill base needed to improve assessments of foreign nuclear programs.**

   - Focus requirements on nuclear expertise to monitor, assess, and analyze the global threats posed by nuclear weapon developments, proliferation of nuclear technology, and potential employment of nuclear weapons or

"dirty bombs" that could threaten the United States, U.S. force abroad, or allies and friends.

- Leadership should challenge current assessments utilizing a peer review process (red teams) to ensure that more of the known and unknown issues are identified and corrective action assigned to competent specialists for resolution.

9. **The Assistant Secretary of Defense for Strategic Weapons (when appointed) and Administrator, NNSA, must maintain critical weapon design, development, production, integration, and surveillance skills by exploring follow-on nuclear weapon system designs, including prototyping (but without commitment to production).**

   - Development of new systems (of any kind) requires certain skills different from those needed to sustain existing systems. For example, designing something new, and bringing it to fruition, requires assessing and balancing design-risks in a way that is not exercised in assessing and maintaining existing systems for which those risk-trades were made by someone else, years or decades before. And, like any skill, the skills needed for new designs cannot be sustained and kept up to date without applying them to real work. Thus, for the nation to sustain the skills needed to develop new nuclear weapons in the future, if and as they may be needed, some degree of on-going exploration of advanced designs is required. (This was one of the reasons for undertaking the RRW, for example.)

   - A program of exploration of follow-on nuclear weapon and weapon system design should be re-established at some level that is decided on by balancing the real risks of doing too little against possible risks of doing too much. Such a program should have a spectrum of work ranging from exploring designs on paper only, to prototyping, to some degree of limited fabrication, since production skills cannot be maintained without being exercised. If necessary, it should be made explicit that such a program would not entail commitment to full production of anything.

   - Increased efforts must be made to ensure nuclear weapons are safe, secure, and reliable. As the numbers of weapons are reduced and refurbishments are required, it is recommended that a process such as competitive dual revalidation be used to sharpen the focus and hone the skills to minimize the existence of possible failure modes (as was done for the W76). The process should be extended from nuclear design

through delivery system integration with support from the DOD prime contractor.

- The full range of real and engaging work is the only validated mechanism for the sustainment of unique skills. Real work exercises and strengthens competencies and sends the message to developers, producers, and operators that the mission is important and a national priority. Sustainment programs cannot be relied upon to exercise and maintain the total competencies required, and especially should not be relied on to prepare the community to respond to new challenges.

- DOD and NNSA must work with the Congress to ensure an annual workload that is reasonably stable yet can accommodate design, development, and production rate changes, and avoid interruptions that compromise long-term mission design and production competence. The production rate must provide the basis for surge should it be necessary. Dismantlement by itself will not adequately sustain needed competencies.

- Some additional provision must be made for skills not needed today to meet current or near-term requirements but possibly needed quickly in the future (in short, a hedging strategy)[24] because the global security environment can change rapidly, possibly faster than we could constitute or reconstitute the needed skills and capabilities in real time.

10. **The Administrator, NNSA, should make the development of capabilities and competencies an explicit part of NNSA planning consistent with the next NPR.**

    - The Administrator should establish and implement both a strategy and plans on a priority basis for the next generation of nuclear stewards, identify and implement strategies and tools for recruiting and retaining essential weapons employees and adopt a comprehensive strategy for knowledge transfer and training that emphasizes the essential contribution of hands-on work.

11. **Cognizant organizations throughout the nuclear enterprise—within government and the supporting contractor base—should maintain selected nuclear skills by managing their application in related non-nuclear applications where appropriate.**

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24. The history of the 1930s is apt here, in both ways. It is unclear whether we responded to the emerging threats in real time, without hedges, or whether some of what we did was—or was regarded as—a hedge. In any case, we barely made it.

- Careful coordination of requirements to describe the minimum set of capabilities needed and thoughtful cost allocation are required to fully leverage activities that are technically similar to nuclear work.

- A key component of a hedging strategy against an uncertain nuclear future is to deliberately structure programs and organizations so that nuclear skills that might be needed in the future are exercised and sustained today. This should be accomplished through current programmatic applications that might also be needed in the nuclear arena in the future. Many of these applications are likely to be non-nuclear.

12. **Cognizant organizations that comprise the nuclear security enterprise (to include NNSA/DOD/IC/DNDO) should strategically develop a human capital management system(s) to identify current and future needed capabilities and manage so personnel can move from one part of the nuclear security enterprise to another as needed.**

Capabilities and Competencies

13. **The Secretary of Defense should require the periodic participation of senior civilian and military leadership in exercises that involve the use of an adversary and/or U.S. nuclear forces.**

14. **The Secretary of Defense should establish Department of Defense requirements for understanding foreign cultural and behavioral factors related to nuclear issues.**

- Potential adversaries generally do not have the same views of their nuclear weapons future as does the United States. Deterring future adversaries will require greater understanding of the goals, culture, values, social characteristics, government limitations, leadership decision-making, and motivations of nations and non-state actors. Such an understanding is an essential component of intelligence needed for competent conduct of U.S. foreign policy. Better training and education are needed for personnel at all levels to include senior personnel and those charged with developing U.S. assurance, dissuasion, and deterrence positions, pronouncements, and use of "red lines."

- The over-all connection between communications and deterrence requires improvement and greater use of red-team activities to improve executive decision-making.

- The Secretary of Defense should urge the President to take similar steps government-wide.

15. **The Secretary of Defense should direct a review of war college core courses of instructions for nuclear strategy and operations to strengthen the preparation of senior military officers for future responsibilities.**
16. **Commander, U.S. Strategic Command, should review errors made in recent years by the operating forces and examine implementation of requirements for command and control of nuclear weapons to determine if more effective procedures can be devised.**
17. **Commander, U.S. Strategic Command, should review with the Director of National Intelligence and strengthen reconnaissance planning for the nuclear dimension of the global strike mission.**
18. **Commander, U.S. Strategic Command should strengthen competence to identify consequences of targeting actions (battle damage assessments).**
19. **The Secretary of the Air Force and Secretary of the Navy should fund advanced development programs to technically evaluate potential replacement systems to maintain and renew necessary skills in anticipation of the end-of-life of U.S. nuclear-capable delivery systems.**

    - In particular, the task force strongly believes an advanced development program for ICBM application is needed to evaluate concepts that might be applied to any follow-on to Minuteman III.

    - Secretary of the Air Force should review the nuclear weapons systems and weapons effects capabilities and expertise resident in the Air Force with the view of determining whether re-establishment of Air Force Weapons Laboratory or other options are needed.

20. **The Assistant Secretary of Defense for Strategic Weapons (when appointed) and Director, Defense Threat Reduction Agency should rebuild the capabilities to define and update the range of nuclear threat environments that U.S. conventional, as well as nuclear, forces may face-in deployed operations and in the homeland.**
21. **The Chairman of the Joint Chiefs of Staff and service chiefs should require that the competencies of military forces operating in nuclear environments be rebuilt.**

- The Chairman and service chiefs should direct that joint education, training, and exercises include aspects of such operations.
- The Secretary of Defense should assign DTRA responsibility for technical support to exercising, gaming, education, and system/network response assessments related to nuclear survivability.

22. **Service chiefs, Director, Defense Threat Reduction Agency, and Administrator, NNSA should grow a new technical design and development skills base for the nuclear weapons effects enterprise.**

- Identify the skills base essential to sustain the current systems and to design, develop, and operate replacement systems.
- Rebuilding this capability should entail modeling and simulation capability analogous to that for weapon design. A minimum "national" nuclear weapons effects simulator enterprise should be defined to maintain the unique expertise necessary to operate ranges and test facilities.
- An exchange program should be implemented between DOD, DOE, and NNSA laboratories to ensure remaining talent stays in the field. This community should be charged with teaching operations, system design, code development, simulator advancement, and hardening innovations.
- A long-term plan for growing and maintaining talent should be developed that is connected with a sustained research and development program in both agencies to ensure a career path for professionals.

Congressional Oversight

23. **Congressional oversight of the nuclear weapons program should be reinvigorated.**

- Historically, the Congress had a major role in the nuclear weapons program. It is our sense that the Congress again needs to take a strong role in overseeing and supporting the conduct of the nuclear weapons program in this critical transition period and should consider organizational changes as may be appropriate to this purpose and staffing with personnel experienced and knowledgeable concerning nuclear weapons systems.

- Focused and structured congressional nuclear weapons program oversight will go a long way to strengthening public and program participants' perceptions that the maintenance of the safety and reliability of the stockpile is, indeed, "a matter of supreme national interest." By investing the time and resources appropriate to a serious and continuing oversight effort, the Congress will give tangible evidence of the importance of the program.
- Such oversight might also provide a basis for the Congress to make clear its commitment to a sustained, multiyear funding of the future program. This is necessary to give talented potential recruits and the existing laboratory and production plant workforce confidence that they will have career opportunities comparable to those of other endeavors they might pursue. Moreover, those attracted to the scientific and technical challenges need to be assured that the high performance computational capabilities and diagnostic tools essential to their work will actually be funded and available.
- The Congress needs to provide explicit, positive reinforcement of the public service character of this undertaking in its deliberations and reports. The deliberations of the Congress and the workings of the committees are closely followed by DOD, NNSA, and its contractor community. Affirmative reinforcement of the mission and its importance in committee reports and floor statements contribute to confidence that their work is valued by the nation and that adequate funding support will be forthcoming.

Appendix A. Nuclear Deterrent Workplace Survey Results

Survey Summary

The Nuclear Deterrent Workplace Survey was conducted to identify and prioritize the important factors in recruiting and retaining personnel for nuclear deterrent organizations.[25] The content of this survey is based on the Nuclear Deterrent Workplace Survey administered in 1999, which was conducted for the DOE workforce. The survey population was expanded in this survey to include both DOE and DOD organizations.[26]

Survey invitations were e-mailed to 19,553 individuals in February 2008.[27] There were 8,266 web surveys returned (42%) (Table A-1). All available survey data were used in this report. Although some respondents did not complete the entire survey, the items that they did complete were used in the analyses described in this report.

Table A-1. Web Survey Submission Status

Total number of web survey invitations sent	19,553
Total number of web surveys returned	8,266

25. The members of this task force would like to extend their thanks to the following individuals, from Data Recognition Corporation, who were instrumental in administering the survey and evaluating its results: Kristofer J. Fenlason, Ph.D., Director of Organization Effectiveness; Anna Chandonnet, MA, Research Consultant; and Colleen Rasinowich, Research Consultant.

26. In this appendix, DOE refers to the various elements of NNSA, which includes the laboratories, plants and headquarters organizations.

27. The survey had more complete coverage for DOE than for DOD. There is a great deal of variation in the approach taken administering the task force survey of the workforce within each organization. Some organizations took a blanket approach and invited many more participants than they had identified as part of the nuclear deterrence workforce. Other sites were very conservative in inviting participation. In the case of the Navy, their deployed submarine crews could not be given access to the survey. To account for the variations in coverage and avoid aggregation biases, our analysis focuses primarily on the results for the individual organizations, or small groups, without aggregation.

We draw the following conclusions from the survey:

- The overall tone of the 2008 survey is positive.
  - 74% would recommend his or her organization as a good place to work.
  - "Gap analysis" shows that the most important five job-satisfaction factors are well provided—and their provision is rated as at least "average" in every case.
- The <30 year old respondents are generally less positive; especially within DOD.
- Challenging work remains the #1 draw identified by respondents.
  - Consistent with this, eliminating factors that conflict with accomplishing work is the #1 item identified for change in the open ended question.
- Respondents generally rate their organizations highly for programmatic focus and technical capability:
  - Ratings for program focus are 6.8 and above (out of 10).
  - Ratings for "ability to address technical issues" are 6.4 and above (out of 10).
  - Ratings are mixed and lower for "policy that enables accomplishment of the mission" and for "balancing the demands of administration against the focus on program deliverables."
- Comparisons of 2008 with 1999 responses within DOE seem to correlate with changes in perceived career stability:
  - Responses indicated substantial erosion in morale at Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL). Both were undergoing layoffs during the 2008 survey period, and responses may reflect this, both in terms of relative ratings in 2008 and changes in their responses since 1999.
  - Perceived stability increased substantially at Pantex, Y12, and the Kansas City Plant, and increased slightly at Sandia and DOE headquarters. Their overall responses are much more positive in 2008 than in 1999.
- An overwhelming fraction of the DOE workforce plans to stay in the nuclear business until retirement.

Survey Demographics

Survey results are reported for the seven major groups shown in Table A-2. The distribution of completed surveys for each group is reported in the table. The overall survey response rate was 42%. The response rate for all DOD groups (DOD [OSD, Joint Staff (JS), and Agencies], Army, Navy, and Air Force) was 44% (3,358 respondents from 7,695 invitations). The response rate for the DOE groups (DOE headquarters, labs, and plants) was 39% (4,744 out of 12,104).

Results also are reported for the nine DOE groups that were covered in the 1999 survey, to facilitate comparisons between the two surveys. The groups from the 1999 report are: Sandia (Sandia National Labs, CA and Sandia National Labs, NM), LLNL, LANL, NTS (Nevada Test Site), KCP (Kansas City Plant), PANTEX, SRS (Savannah River Site), Y-12 (Oak Ridge/Y-12), and DOE headquarters.[28]

Figure A-1 shows the age distribution for the seven main groups and for the overall population. Four age bands are shown: 30 years old or younger, 31 to 40 years old, 41 to 50 years old, and 51 years old or older. The ages were grouped in this manner to parallel the age groups from the 1999 report.

The Department of Energy (labs, plants, and DOE headquarters) has the highest percentage of older employees where 73% to 79% are 41 years old or older. The Air Force has the youngest population—38% of the employees are 30 years old or younger and only 24% are 41 years or older.

Figure A-2 shows the education level of the groups. DOE laboratories have the highest number of PhD and post-doctoral employees and the Army has the highest percentage of Master's degrees and the smallest number of employees with an Associates Degree or less education.

28. The 1999 raw survey data were not available and, as such, formal tests of statistical differences could not be performed between the 2008 and 1999 survey data.

Table A-2. Survey Response

Respondent Groups	Number Received	
	2008 Survey	1999 Survey
DOD (Other than services) (OSD Policy, OSD Acquisition, Joint Staff, DTRA, DIA, Other Intel, STRATCOM, Other Combatant Commands)	1,477	--
Army	54	--
Navy	142	--
Air Force	1,685	--
DOE Labs	--	--
• Sandia (Sandia National Labs, CA and NM)	1,147	1,054
• LLNL (Lawrence Livermore National Labs)	1,301	1,094
• LANL (Los Alamos National Labs)	454	1,331
• NTS (Nevada Test Site)	112	358
DOE Plants	--	--
• KCP (Kansas City Plant)	241	454
• PANTEX	761	801
• SRS (Savannah River Site)	12	84
• Y-12 (Oak Ridge / Y-12)	608	353
DOE Headquarters (NNSA HQ, NNSA Site Offices and Service Center, DOE Other)	259	204
TOTAL	**8,266***	**5,733**

* Respondents could select membership to multiple groups. The total values are representative of only unique members. That is, a respondent is only counted once for the total group.

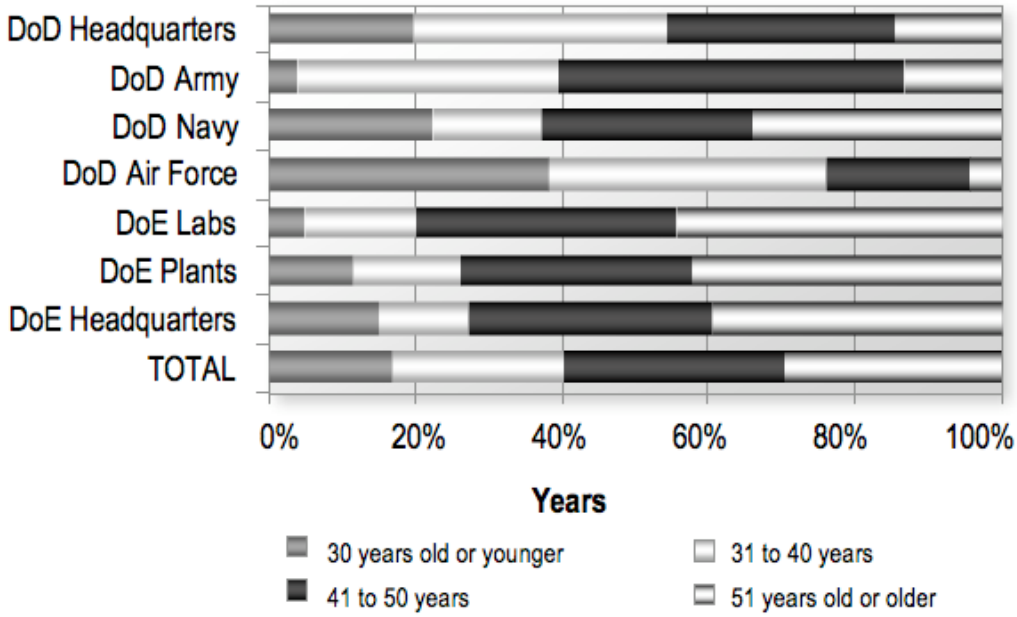


Figure A-1. Age Bands by Group

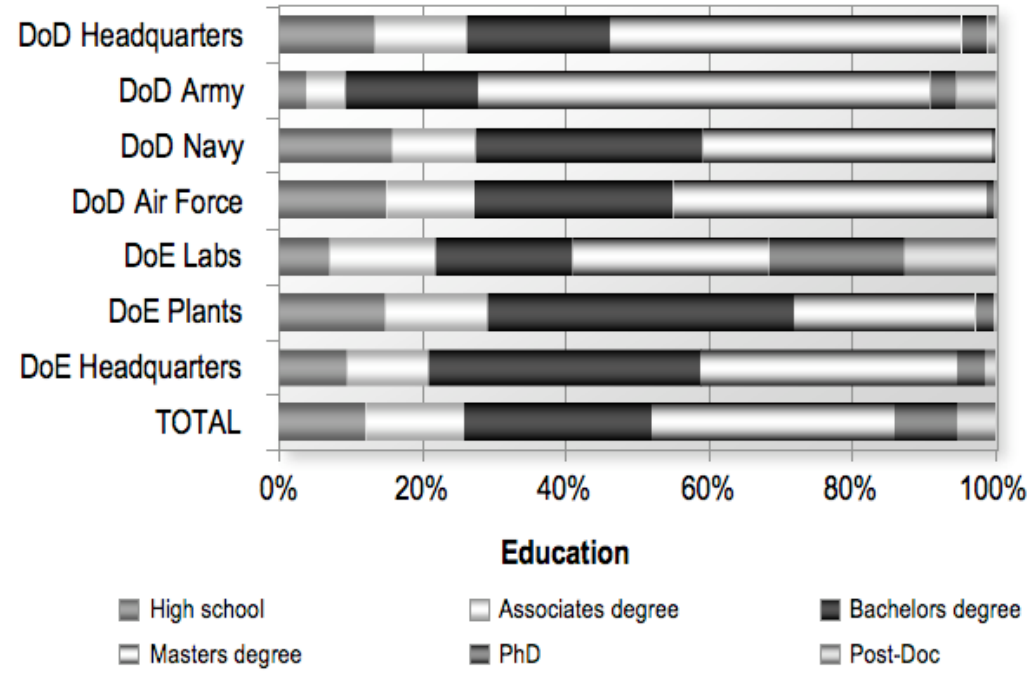


Figure A-2. Level of Education by Group

The survey also gave respondents the opportunity to indicate their area of employment, their role, and whether they were civilian or military (questions 22, 23, and 24). Note, respondents could mark multiple responses of all three of these survey questions. The most common areas of employment for respondents were Science and Technology (33% of respondents marked this option), Design, Engineering and Research Development (32%), and Military Operations (25%). The most frequent role that employees indicated was Engineer (34%), followed by Operator (21%), Technician (19%), and Scientist (18%). Forty percent (40%) of survey respondents are Civilian Contractors, 31% are Military, and 12% marked that they were Federal Employees.

Context: Perception of Career Stability

Career stability is an important context variable that is correlated with responses both across organizations and between the 1999 and 2008 surveys. For DOE, stability was perceived to increase significantly within the plants, but to decrease in LLNL and LANL. The 2008 survey was administered during a period when both of these laboratories were undergoing layoffs.

The 2008 survey asked, "How do you rate the career stability offered by the nuclear deterrence related work?" The response scale was:

- Not Stable = 0, 1
- Slightly Stable = 2, 3
- Somewhat Stable = 4, 5, 6
- Mostly Stable = 7, 8
- Completely Stable = 9, 10

This item scale has been modified from the 1999 Survey to align with best survey construction practices. The original scale was: Unstable = 0, 1; Poor = 2, 3; Average = 4, 5, 6; Good = 7, 8; and Excellent = 9, 10.

As shown in Table A-3, the score range is from 4.1 to 6.9, which falls into the Somewhat Stable to Mostly Stable response categories. For most of the groups, the average score increased from the 1999 to 2008 survey administration. LLNL and LANL have the lowest average scores. Army, Navy, and PANTEX are the groups with the highest average score.

It is interesting to note, that younger employees seem to have a better outlook than older employees on the career stability offered by nuclear deterrence work.

Table A-3. How Do You Rate the Stability of the Program?

DOD (OSD, JS, Agencies)	Army	Navy	DOD Air Force	DOE Labs	DOE Plants	DOE Headquarters
5.6	6.5	6.9	5.9	4.6	6.2	5.6

	LANL	Sandia	LLNL	KCP	PANTEX	Y-12	SRS	DOE HQ	NTS
2008	4.3.	5.3	4.1	5.5	6.5	5.9	4.8	5.6	4.6
1999	4.9	4.7	4.9	2.5	3.4	2.9	4.3	4.3	3.9

Would You Recommend Your Organization?

A key question used by the DSB in site visits to gauge the morale of each organization was, "Would you recommend your organization to a friend or relative as a good place to work?" A similar question was included in the survey.

Overall, 74% of survey respondents answered "yes," and over half of the respondents from every group replied, "yes" (Table A-4). Army had the highest percentage (89%) followed by Navy, Sandia, KCP, and Y-12. The KCP and Y-12 groups had the lowest percentages for the 1999 survey results and are now one of the highest.

Table A-4. Would You Recommend Your Organization? (Percent Responding "Yes")

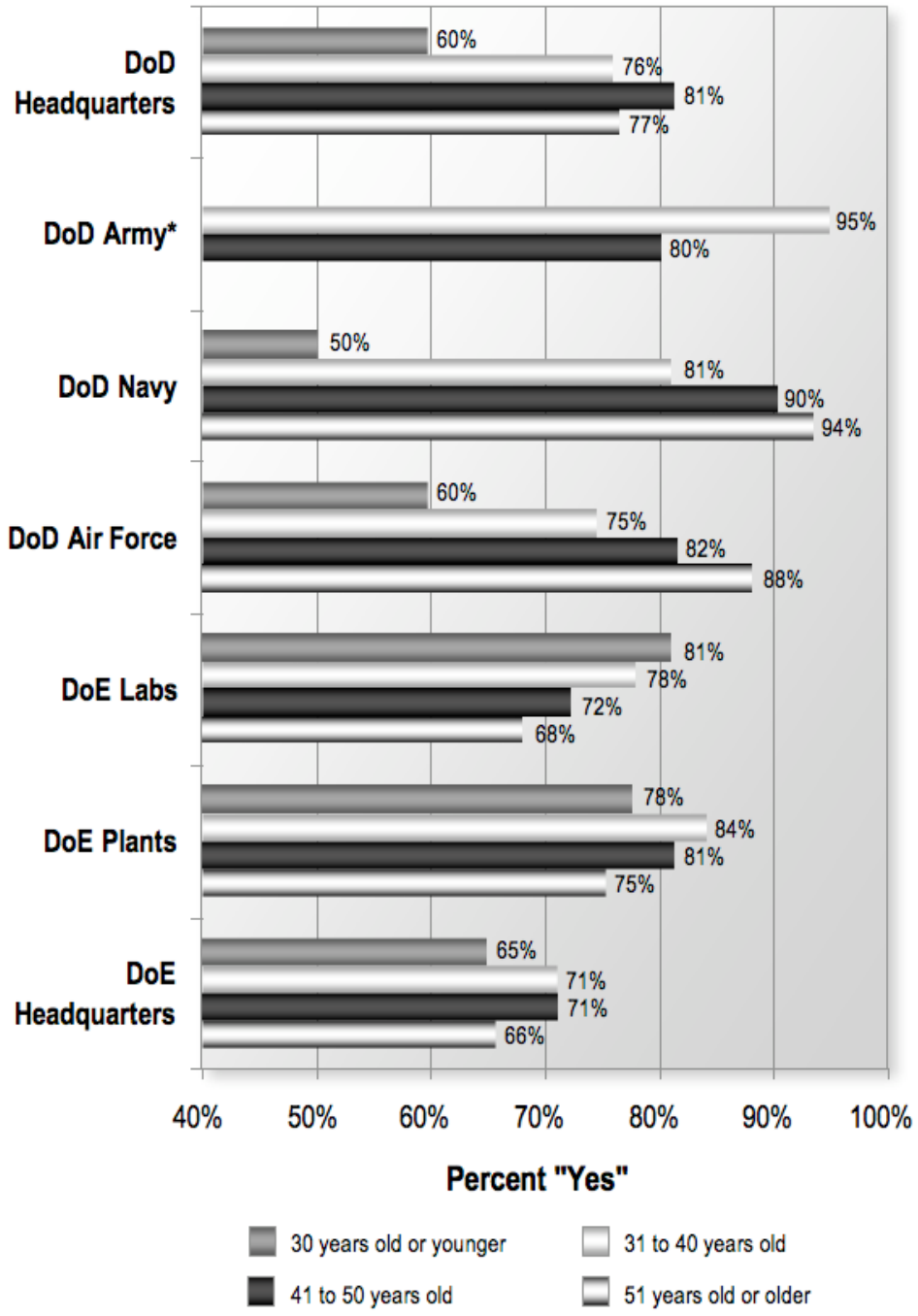
DOD (OSD, JS, Agencies)	Army	Navy	DOD Air Force	DOE Labs	DOE Plants	DOE Headquarters
74%	89%	81%	71%	72%	79%	68%

	LANL	Sandia	LLNL	KCP	PANTEX	Y-12	SRS	DOE HQ	NTS
2008	55%	81%	70%	81%	77%	80%	67%	68%	68%
1999	85%	78%	84%	57%	70%	51%	67%	51%	68%

The respondents least likely to recommend their organization are at LANL followed by Security personnel and employees who are 30 years old or younger. In 1999, the LANL group had the highest percentage of employees report that they would recommend their organization. A parallel, but less dramatic decline occurred at LLNL.

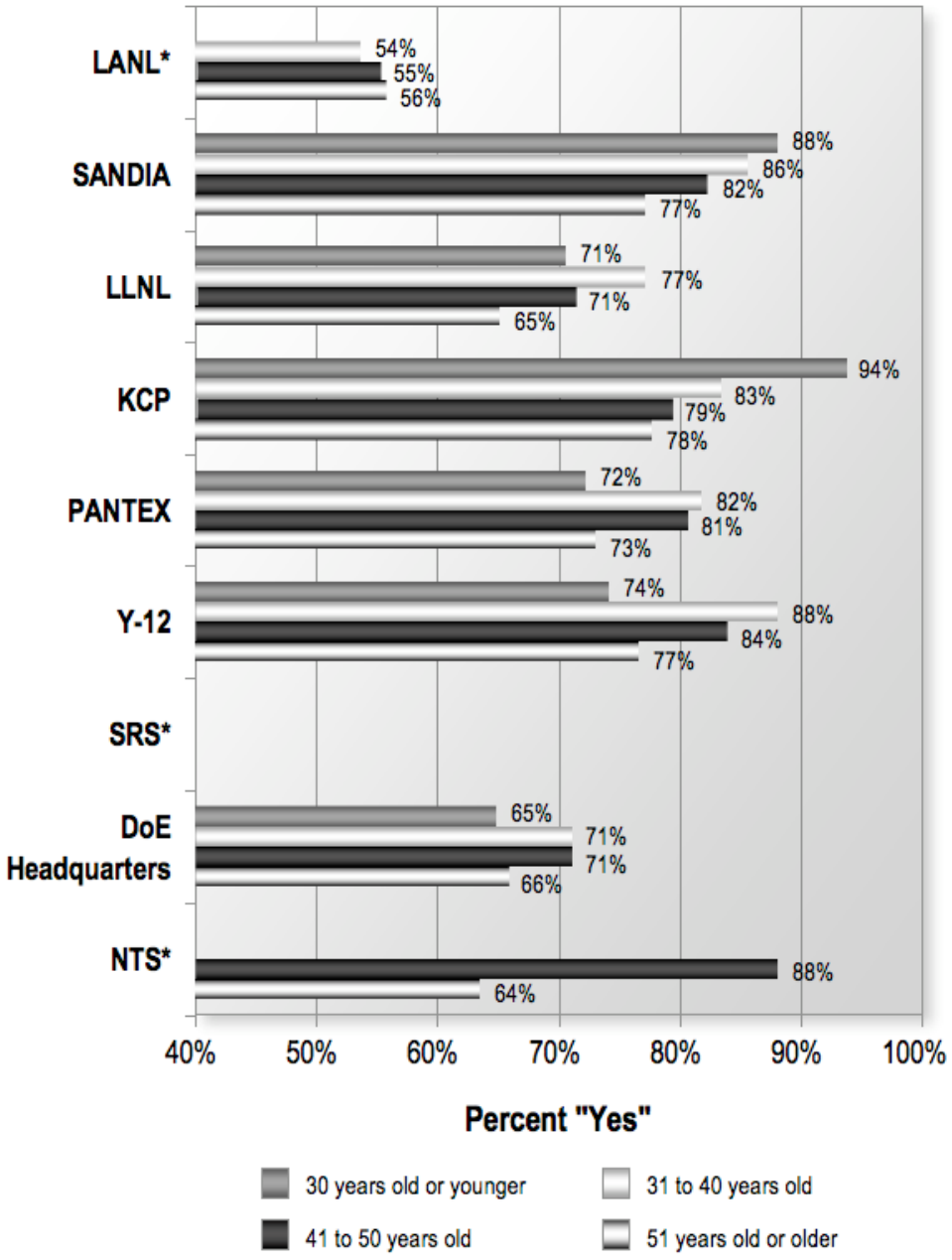
Overall, younger participants were less positive in recommending employment in their organization. Survey participants in the 30 years old or younger age group had the lowest percentages for DOD (OSD, JS, Agencies), Navy, Air Force, and DOE headquarters (see Figure A-3). In contrast, at the DOE Labs the younger employees were more likely to recommend their organization than the older employees.

Survey participants in the 30 years old or younger age group had the lowest percentages for PANTEX, Y-12, and DOE headquarters (see Figure A-4). For SANDIA, KCP, and NTS, the younger employees were more likely to recommend their organization than the older employees.



* Survey results displayed for groups with 10 or more members.

Figure A-3. Would You Recommend Your Organization, by Group and Age



* Survey results displayed for groups with 10 or more members.

Figure A-4. Would You Recommend Your Organization, by Site and Age

What Initially Attracted You to Your Organization?

The survey included an open-ended question to probe the recruiting issue by asking, "What initially attracted you to your organization and nuclear deterrence work?" Table A-5 lists the coding categories for the responses to this question. A total of 9,181 comments were provided about the initial attraction to your organization and nuclear deterrence work.

Table A-5. Coding Categories for "What Attracted You…"

	Category
01	Management
02	Coworkers
03	Wages / Pay / Salary
04	Benefits
05	Tools / Technology
06	Job Stability / Security
07	Job Satisfaction / Challenge / Interest
08	Training and Personal Development
09	Career Advancement and Opportunity
10	Work Site / Location
11	Reputation / Image of Organization
12	Military Service
13	Importance of National Mission / National Security / Country's Well-being
14	General
15	Miscellaneous
16	NULL Comments (e.g., N/A, Nothing, No Comments)

Far and away, the most common comment category was Job Satisfaction/Challenge/Interest (34%). The next most frequently occurring comments theme was the Miscellaneous category (15%), Importance of National Mission (10%), and Work site/Location (9%). Sub-themes prominent in the Miscellaneous comment category include (military) assignment, job offer/job opportunity, and the Recruiter. Examples are provided in Tables A-6 and A-7.

Table A-6. Comments Illustrating the Importance of Job Satisfaction/Challenge/Interest

Job Satisfaction/Challenge/Interest	
■	I wanted to work on challenging technical projects that made a difference with highly talented scientists and engineers.
■	Challenging research issues, top-notch staff, adequate compensation, excellent benefits, and job security.
■	Variety of work and opportunities, benefits, job security.
■	The challenges and the new technology available to facilitate my work and the chance to work on technically interesting subjects in a nationally important field.
■	1. Opportunity for professional development in the development of a new scientific facility. 2. Opportunity to develop and work on extremely challenging scientific program of national importance and to take a leadership role in this work.
■	High caliber of work required as well as the prestige of contributing to our nation's security and deterrence. I also wanted to work in a worthwhile manufacturing related environment and not having to move away from my community.

Table A-7. Comments Illustrating the Importance of National Mission

Importance of National Mission	
■	To work with the most talented scientific people doing science and technology research and development in the best interest of our country. To be creative and innovative, to be part of a dedicated team, to always be learning through my work.
■	The mission. I was impressed with the mission and the camaraderie of the squadron and wanted to be a vital piece of defending our nation.
■	The national security mission, the level and education of the staff, and the ability to push the state-of-the-art in my technology area.
■	The ability to support the nation and work in a defense-related area. Job stability and location were also important considerations.
■	Working in National Security for the Defense of the United States in a secure work environment that will allow for personal growth.
■	Outstanding opportunity to have an impact on National level issues. Recognized the importance of the mission.

How Effective is Your Organization in Attracting New Hires, and How do you Rate the Skill Level of New Hires?

Organizational Effectiveness

The survey asked, "Overall, how effective is your organization in attracting new hires with needed skills and experience?" (Table A-8). The response scale was:

- Not Effective = 1, 2, 3
- Of Average Effectiveness = 4, 5, 6, 7
- Very Effective = 8, 9, 10

Table A-8. How Effective is Your Organization in Attracting New Hires?

DOD (OSD, JS, Agencies)	Army	Navy	DOD Air Force	DOE Labs	DOE Plants	DOE Headquarters
5.4	5.7	5.7	5.4	5.3	5.2	5.1

Skill Level of New Hires

The scale for rating the skills of new hires was:

- Very Weak Skills = 0, 1
- Weak Skills = 2, 3
- Neither Weak nor Strong Skills = 4, 5, 6
- Strong Skills = 7, 8
- Very Strong Skills = 9, 10

This item scale has been modified from the 1999 Survey to align with best survey construction practices. The original scale was: Very Discouraged = 0, 1; Disappointed = 2, 3; Acceptable = 4, 5, 6; Pleased = 7, 8; and Beyond Expectations = 9, 10.

New hires are the weakest in the following: Writing skills, Organizational skills, and Leadership skills (Figure A-5).

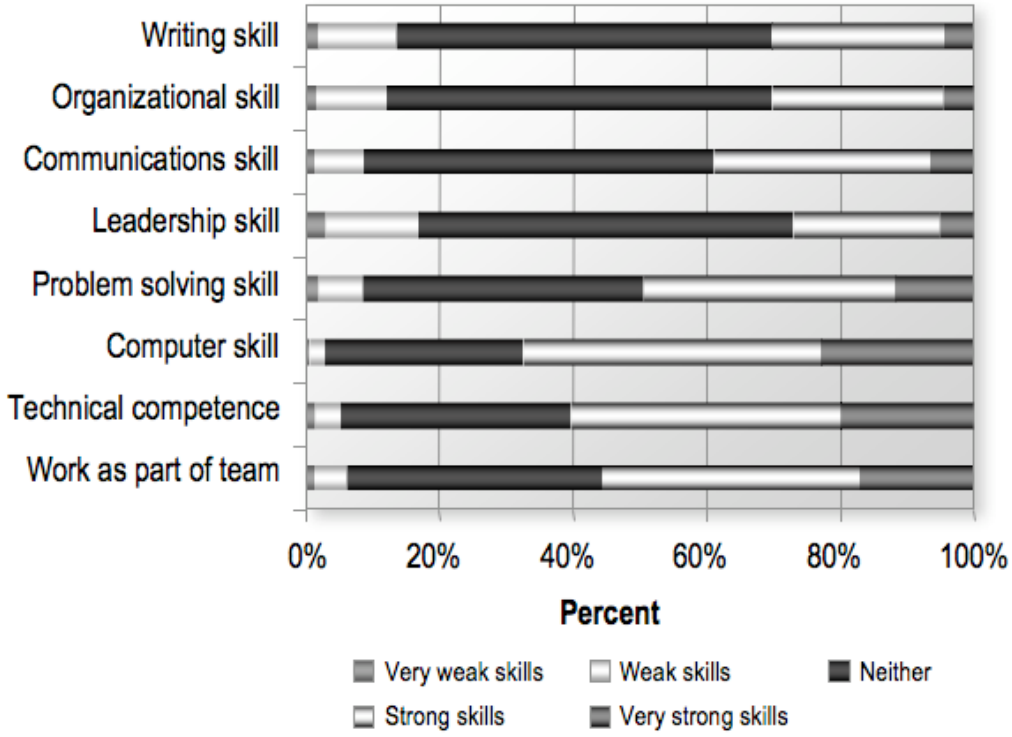


Figure A-5. Overall Skill Level of New Hires

What Job-Related Factors are Most Important and How Well Are they Provided?

The survey examined 16 job-related factors that contribute to satisfaction or dissatisfaction. One set of questions asked respondents to judge the importance of the factor on a scale of 1 to 10. A second set of questions asked respondents to judge how well his or her organization provided the factor, again on a scale of 1 to 10.

The definitions of the job-related factors addressed in the survey are as follows:

- Challenging Work = Interesting and challenging work
- Benefits = Benefits (insurance, vacation, sick leave, pension, etc.)
- Job Security = Employment (job) security
- Salary = Compensation/salary

- W / Respect = Being treated with respect
- Self-improve = Opportunity for self-improvement
- QOL = The Quality of Life in the community where your job is located
- Advancement = Opportunity for advancement and promotion within the organization
- Inter. Comm. = Quality of internal communications, *i.e.*, how well you are kept informed
- Reputation = Professional reputation of the organization
- Co-workers = Stimulation from working with co-workers. (This item was previously "Stimulation from working with smart people" in the 1999 Survey Report.)
- Recog. Perf. = Organization's policy for recognizing and rewarding outstanding performance
- Work Env. = Physical work environment
- Chg W / I Org – Opportunity for changing jobs within organization
- Prestige = Opportunity for acquiring increased professional prestige or peer recognition
- Natl. Contrib. = Opportunity to make a nationally important contribution

The top five workplace factors that contribute to job satisfaction were the same in both 1999 and in 2008. These are: benefits, being treated with respect, job security, challenging work, and salary. The factor that moved the most on the list and has the biggest difference in rating from 1999 to 2008 is "Opportunity to make a nationally important contribution (Nat.l Contrib.)." This factor was towards the bottom of the list in 1999 and in the middle in 2008. The importance rating for this job-related factor increased by more than one point for the following groups: KCP, PANTEX, Y-12, SRS, and NTS. The rest of the factors remained relatively consistent.

Provision of Job-Related Factors

The overall trend appears to be that job-related factors are provided better than when the 1999 survey was administered (Table A-9). There were no major differences in average score between Military Personnel and Civilian Contractors.

- Below Average = 1, 2, 3
- Average = 4, 5, 6
- Above Average = 8, 9 10

Table A-10 shows the average rating for how well each job-related factor is provided by group for all employees who are 30 years old or younger. For most of the job-related factors there was little change in the respondent's assessment between 1999 and 2008 (Table A-11). Improved provision is noted for the factors with the largest differences: (Employment stability (job) security, Compensation (salary), Opportunity for advancement and promotion within the organization, and Organization's policy for recognizing and rewarding outstanding performance).

Table A-9. How Well Job-Related Factors Are Being Provided by Group (Sorted by Overall Importance Average)

	DOD HQ	Army	Navy	Air Force	DOE Labs	DOE Plants	DOE HQ
Benefits	7.5	7.6	7.3	7.5	7.1	6.8	7.5
w/ respect	6.7	6.9	6.9	6.7	6.5	6.1	6.2
Job Security	7.7	7.7	8.0	7.7	6.2	6.9	7.4
Chalng Work	6.9	7.7	7.2	6.6	7.4	6.7	6.9
Salary	6.7	6.8	6.8	6.7	6.4	6.2	7.0
Self-improve	6.7	6.9	6.9	6.8	6.4	5.9	6.0
QOL	6.8	7.1	7.2	6.4	7.1	7.2	7.1
Natl. Contrib.	7.3	7.9	7.6	7.3	7.4	6.9	6.7
Inter. Comm.	5.7	6.2	6.3	5.9	5.3	5.3	5.2
Reputation	6.9	7.0	7.6	7.1	6.9	6.1	5.7
Advancement	5.9	6.2	6.2	6.2	5.2	5.0	5.2
Recog. Perf	6.0	6.2	6.1	6.3	5.3	5.0	5.3
Co-workers	6.8	7.0	7.2	6.8	7.2	6.2	6.2
Work Env	6.6	6.3	6.8	6.4	6.4	5.6	6.1
Chg w/i Org	5.9	6.5	5.7	5.6	6.2	5.3	5.4
Prestige	6.0	6.5	6.4	6.2	5.7	5.1	5.2

Table A-10. How Well Job-Related Factors Are Being Provided by Group 30 Years Old or Younger Only (Sorted by Overall Importance Average)

	DOD HQ	Army	Navy	Air Force	DOE Labs	DOE Plants	DOE HQ
Benefits	7.0	***	6.8	7.2	7.3	7.0	6.9
w/ respect	5.8	***	5.4	6.1	7.2	6.6	6.2
Job Security	7.4	***	7.9	7.6	6.6	7.2	7.5
Chalng Work	5.7	***	5.7	5.8	7.3	6.4	6.6
Salary	6.2	***	6.3	6.3	6.3	5.8	6.1
Self-improve	6.2	***	6.0	6.6	7.0	6.2	6.4
QOL	5.6	***	6.4	5.5	6.8	6.8	6.4
Natl. Contrib.	6.6	***	6.7	6.8	7.7	6.8	7.0
Inter. Comm.	5.3	***	5.7	5.6	5.4	5.3	5.6
Reputation	6.7	***	6.7	6.9	7.4	6.4	6.5
Advancement	5.8	***	5.7	6.1	5.5	5.3	6.2
Recog. Perf	5.4	***	5.0	5.9	5.1	5.0	5.6
Co-workers	6.3	***	6.2	6.4	7.2	6.2	6.7
Work Env	5.8	***	5.9	6.0	6.7	5.4	6.3
Chg w/i Org	5.5	***	4.7	5.5	7.0	5.7	5.9
Prestige	5.8	***	5.7	6.0	5.8	5.1	5.8

***There were only two respondents for this category.

Table A-11. How Well Job-Related Factors Are Being Provided Compared to 1999 Survey Results (Sorted by Overall Importance Average)

	Year	LANL	Sandia	LLNL	KCP	PANTEX	Y-12	SRS	DOE HQ	NTS
Benefits	**2008**	7.0	7.4	6.9	6.8	7.0	6.6	7.2	7.5	6.7
	1999	7.1	6.7	7.6	6.0	6.4	6.5	5.9	7.3	6.1
W / respect	**2008**	5.7	7.0	6.5	6.5	5.8	6.2	6.5	6.2	6.6
	1999	6.4	6.7	6.4	5.7	5.4	5.6	6.4	5.7	6.4
Job Security	**2008**	5.7	7.5	5.3	6.5	7.1	6.8	6.9	7.4	6.1
	1999	6.6	7.1	7.2	3.4	4.9	4.5	5.5	6.1	5.7
Chalng Work	**2008**	7.0	7.5	7.5	7.1	6.7	6.7	6.8	6.9	7.5
	1999	7.4	7.2	7.5	6.6	6.1	6.3	6.4	6.4	6.7
Salary	**2008**	6.5	6.4	6.2	5.4	6.3	6.4	6.8	7.0	6.4
	1999	5.6	5.4	5.2	3.8	6.0	5.0	5.6	6.5	6.0
Self-improve	**2008**	5.7	7.0	6.1	6.1	5.9	5.9	6.2	6.0	6.2
	1999	6.6	6.7	6.6	5.8	5.2	5.3	5.9	5.8	5.9
QOL	**2008**	6.6	7.1	7.4	7.1	7.0	7.5	6.3	7.1	6.5
	1999	7.2	6.6	6.9	7.1	7.1	7.2	7.6	7.1	6.5
Natl. Contrib.	**2008**	7.0	7.5	7.5	7.0	6.9	7.0	6.9	6.7	7.3
	1999	7.4	7.1	7.2	5.4	5.5	5.6	5.8	5.9	6.1
Inter. Comm.	**2008**	4.6	5.7	5.2	6.1	5.1	5.2	4.8	5.2	5.3
	1999	5.0	6.3	5.2	5.9	4.5	4.3	5.6	4.4	5.2
Reputation	**2008**	5.8	7.2	7.1	6.8	6.1	6.0	6.2	5.7	6.4
	1999	7.5	7.4	7.2	6.1	5.7	6.1	6.5	5.3	6.0
Advancemnt	**2008**	4.8	5.6	5.0	5.0	5.0	5.0	5.2	5.2	5.1
	1999	4.8	4.8	5.2	3.3	4.0	3.7	4.5	4.1	4.8
Recog. Perf	**2008**	4.7	5.7	5.1	5.1	5.0	5.0	5.0	5.3	5.1
	1999	4.8	5.4	4.5	4.2	4.2	3.9	5.2	4.9	4.9
Co-workers	**2008**	6.6	7.4	7.2	6.6	6.0	6.2	6.4	6.2	6.8
	1999	7.6	7.9	7.8	6.4	5.6	6.4	6.8	6.2	6.7
Work Env	**2008**	5.3	6.9	6.5	6.0	5.7	5.4	7.3	6.1	6.3
	1999	5.4	6.5	6.8	5.7	5.4	5.0	5.5	5.2	6.5
Chg w/i Org	**2008**	5.4	6.9	5.8	5.6	5.1	5.5	5.3	5.4	5.5
	1999	6.2	6.7	6.8	4.7	5.3	4.7	5.8	5.2	5.6
Prestige	**2008**	5.2	6.1	5.6	5.4	5.0	5.0	5.7	5.2	5.6
	1999	6.0	5.8	5.5	4.7	4.2	4.2	5.2	5.1	5.1

The consistent pattern across all groups that can be directly compared is that of improvement or increases from 1999 levels to 2008. The largest increases between the 2008 and 1999 survey data are for Job Security for the KCP, PANTEX, and Y-12 groups. LANL and LLNL show much higher numbers of scores that declined from 1999 to 2008 across several job factors. The remaining groups and job-related factors had only minor changes if any from 1999 to 2008.

Importance vs. How Well Provided

The difference between the average values given by the respondents to "Importance" and "How Well Provided" were compared for each job-related factor, by group. A difference of 3.0 or more was considered worthy of analysis in the 1999 Survey report. For the 2008 report, a gap of 2.0 or more will be reported because of the very few occurrences of differences 3.0 or greater. These differences are presented in Table A-12.

Table A-12. Importance versus How Well Provided by Group (Differences ≥ 2.0 Only) (Sorted by Overall Importance Average)

	DOD HQ	Army	Navy	Air Force	DOE Labs	DOE Plants	DOE HQ
Benefits						2.3	
w/ respect	2.1			2.2	2.2	2.7	2.6
Job Security					2.5	2.0	
Chalng Work							
Salary					2.1	2.8	
Self-improve						2.3	2.4
QOL				2.1			
Natl. Contrib.							
Inter. Comm.	2.5	2.2		2.4	2.4	2.6	2.9
Reputation							2.2
Advancement	2.2			2.0	2.5	3.0	2.8
Recog. Perf					2.3	2.7	2.6
Co-workers							
Work Env							
Chg w/i Org							
Prestige							2.0

The factors with the most frequent large difference are: Being treated with respect (w/ respect), Quality of internal communications (Inter. Comm), and Opportunity for advancement and promotion within the organization (Advancement). The DOE Plants group has the most job-related factors with gaps larger than 2.0 followed by DOE Labs and DOE Headquarters. All groups have at least one factor with a gap except for Navy.

For Military Personnel, the largest gaps can be found between the following job factors: Being treated with respect, Quality of Life, Quality of internal communications, and Opportunity for advancement (2.2, 2.0, 2.4, and 2.0, respectively). For Civilian Contractors, the factors with the largest differences are: Benefits, Being treated with respect, Employment (job) security, Compensation (salary), Quality of internal communication, Opportunity for advancement, and Policy for recognizing and rewarding outstanding performance (2.0, 2.3, 2.3, 2.4, 2.4, 2.6, and 2.4, respectively).

The factors with the most frequent large differences are: Being treated with respect (w/ respect), Opportunity for self improvement (Self-improve), Quality of internal communications (Inter. Comm), Opportunity for advancement and promotion within the organization (Advancement), and Organization's policy for recognizing and rewarding outstanding performance (Recog. Perf). The PANTEX and Y-12 groups have the most job-related factors with gaps larger than 2.0. All groups have at least one factor with a gap.

The dominant pattern between 1999 and 2008 is one of decreasing gaps (Table A-13). Given that the relative rating of importance remains stable between the 1999 and 2008 surveys, this reduction appears to be due to improvement in how well the factor is being provided.

Table A-14 provides the gap analysis for respondents who are 30 years old or younger. Many more gaps are evident for this younger age group than for the survey population as a whole. The factors with the most frequent large differences are: Compensation (salary), Quality of internal communications (Inter. Comm), and Opportunity for advancement and promotion (Advancement). The DOE Headquarters group has the most job-related factors with gaps larger than 2.0. DOD (OSD, JS, Agencies) has the most factors with gaps larger than 3.0. DOE Plants has the largest gaps (3.4) of all the groups for the following factors: Compensation (salary) and Opportunity for advancement and promotion (Advancement).

Table A-13. Importance versus How Well Provided Compared to 1999 Survey Results (Differences ≥ 2.0 Only) (Sorted by Overall Importance Average)

	Year	LANL	Sandia	LLNL	KCP	PANTEX	Y-12	SRS	DOE HQ	NTS
Benefits	**2008**			2.1	2.2	2.1	2.5			2.2
	1999				3.0					
W / respect	**2008**	3.1		2.3	2.2	3.0	2.5	2.3	2.6	
	1999				3.0	3.4	3.1			
Job Security	**2008**	2.8		3.6	2.1		2.1			2.8
	1999				5.6	4.0	4.5	3.2		
Chalng Work	**2008**									
	1999									
Salary	**2008**		2.1	2.3	3.4	2.7	2.5			2.3
	1999		3.0	3.2	5.2	3.0	3.7			
Self-improve	**2008**	2.7		2.2	2.0	2.5	2.2		2.4	2.0
	1999									
QOL	**2008**									
	1999									
Natl. Contrib.	**2008**									
	1999									
Inter. Comm.	**2008**	3.2		2.6		3.0	2.6	3.3	2.9	2.5
	1999					3.8	4.0		3.7	
Reputation	**2008**	2.3							2.2	
	1999									
Advancement	**2008**	2.8	2.0	2.8	2.8	3.0	3.0	3.1	2.8	2.5
	1999	3.0			4.8	4.2	4.7	4.0	3.7	3.4
Recog. Perf	**2008**	3.0		2.6	2.6	2.6	2.7	3.0	2.6	2.5
	1999	3.0		3.4	3.6	3.4	3.9			
Co-workers	**2008**									
	1999									
Work Env	**2008**					2.0	2.0			
	1999									
Chg w/i Org	**2008**					2.2				
	1999									
Prestige	**2008**								2.0	
	1999									

Table 14. Importance Vs. How Well Provided by Group 30 Years Old or Younger Only (Differences ≥ 2.0 Only) (Sorted by Overall Importance Average)

	DOD HQ	Army	Navy	Air Force	DOE Labs	DOE Plants	DOE HQ
Benefits		***				2.2	2.3
w/ respect	3.2	***	3.2	3.0		2.2	2.8
Job Security		***			2.0		
Chalng Work	2.6	***	2.1	2.5		2.1	2.1
Salary	2.4	***	2.2	2.1	2.5	3.4	2.8
Self-improve	2.5	***	2.3	2.2		2.5	2.5
QOL	3.0	***	2.3	3.1			2.7
Natl. Contrib.		***					
Inter. Comm.	3.1	***	2.2	2.8	2.2	2.5	3.1
Reputation		***					2.1
Advancement	2.7	***	2.7	2.3	2.8	3.5	2.7
Recog. Perf	2.2	***	2.8		2.6	2.9	2.6
Co-workers		***					
Work Env	2.2	***		2.0		2.0	2.0
Chg w/i Org	2.2	***	2.5	2.4			2.4
Prestige		***				2.0	2.4

***There were only two respondents for this category.

Do You Intend to Perform Nuclear Deterrence Related Work Until Retirement?

Another question asked, "Do you intend to perform nuclear deterrence related work until you retire?" (Table A-15). Sorted by age group, individuals over 40 years of age want to remain with nuclear weapons work more than younger individuals. Sorted by jobs, technicians indicated more interest in stability. DOD (OSD, JS, Agencies) and Air Force indicate the lowest intention to continue nuclear deterrence work until retirement.

Table A-15. Do you intend to perform nuclear deterrence related work until you retire? (Percent Responding "Yes")

DOD (OSD, JS, Agencies)	Army	Navy	DOD Air Force	DOE Labs	DOE Plants	DOE Headquarters
51%	83%	62%	37%	71%	84%	72%

	LANL	Sandia	LLNL	KCP	PANTEX	Y-12	SRS	DOE HQ	NTS
2008	77%	69%	70%	86%	82%	87%	92%	68%	90%
2009	74%	65%	70%	74%	74%	79%	67%	70%	64%

	Overall**	≤ 30 Years	31-40 Years	41-50 Years	≥ 51 Years
2008	63%	28%	49%	70%	87%

	Scientist	Engineer	Technician	Operator	Maintainer	Trainer	Security	Policy	Analyst
2008	71%	71%	74%	45%	67%	62%	47%	66%	71%

Only 38% of Military Personnel intend to perform nuclear deterrence related work until they retire. In contrast, 76% of Civilian Contractors responded "yes" to this item.

Effectiveness of the Organization

The survey asked, "How effective is your organization with regard to a) focus on the program and mission, b) ability to address technical challenges, c) in setting policies that support performance of the mission, and d) in balancing administrative demands against the performance of the mission?" The response scale was:

- Not Effective = 1, 2, 3
- Of Average Effectiveness = 4, 5, 6, 7
- Very Effective = 8, 9, 10

This item has been modified from the 1999 Survey to align with best survey construction practices. It originally read "What is your level of confidence in your Organization's management actions and statements with regard to…" and had six categories. The original response scale was: Lack Confidence = 1, 2, 3; Confident = 4, 5, 6, 7; and Very Confident = 8, 9, 10. The two highest-rated

categories in 1999 were not included in the 2008 survey's modified question. It was modified to conform to best practices of survey design (i.e., the question stem and response options match).

The responses indicate the organization is effective in maintaining programmatic focus and commitment to the nuclear mission (Prog & Msn) and maintaining the ability to address technical issues (Tech) (Table A-16). The rank order of the four categories is consistent with the 1999 survey results (Table A-17).

Navy is consistently rated higher than average in terms of effectiveness for all four categories. In contrast, DOE is consistently rated lower than average in terms of effectiveness in all four categories. The pattern of results by Service group shows that Policy and Admin are consistently rated lowest across all Service group.

No site stands out in terms of receiving consistently high ratings for effectiveness in the organization. SANDIA is effective in maintaining the ability to address technical issues. KCP is effective in maintaining programmatic focus and commitment to the nuclear mission. KCP, PANTEX, Y-12, and SRS are effective in balancing the demands of administrative workload against the focus of program deliverables. SRS is also effective in clarifying and implementing policies, procedures and practices that enable accomplishment of the organization's missions. Meanwhile, LANL is consistently rated the lowest in terms of effectiveness in all four categories.

Table A-16. Effectiveness in Organization by Group

	DOD HQ	Army	Navy	Air Force	DOE Labs	DOE Plants	DOE HQ
Prog and Msn	6.8	6.8	7.9	7.0	7.1	7.3	6.8
Tech	6.8	6.7	7.4	6.9	6.8	6.4	6.4
Policy	6.2	6.1	6.6	6.3	5.4	6.0	5.5
Admin	5.8	5.6	6.1	5.8	5.1	5.7	5.3

Table A-17. Effectiveness in Organization Compared to 1999 Survey Results

	Year	LANL	Sandia	LLNL	KCP	PANTEX	Y-12	SRS	DOE HQ	NTS
Prog and Msn	**2008**	6.3	7.1	7.3	7.8	7.3	7.2	7.0	6.8	6.9
	1999	3.1	6.0	6.9	6.8	6.5	6.2	6.6	5.9	6.2
Tech	**2008**	5.8	7.1	6.9	7.0	6.3	6.4	6.8	6.4	6.8
	1999	6.3	6.3	6.7	5.7	6.0	5.5	5.9	5.4	6.0
Policy	**2008**	4.1	5.5	5.7	6.2	6.0	5.9	6.3	5.5	5.4
	1999	5.5	5.7	6.0	6.2	5.9	5.4	5.7	4.9	5.3
Admin	**2008**	4.1	5.2	5.4	5.7	5.7	5.7	5.7	5.3	5.1
	1999	4.9	5.2	5.6	5.9	5.1	4.7	4.9	4.6	5.2

In the site groups that can be directly compared from 1999 to 2008 the dominant pattern is that all areas tended to improve. In contrast, LANL registers declines in the areas of technical, policy, and administrative effectiveness.

What are the Demands on Your Time?

The response scale was:

- Never = 1
- Very Little Time = 2, 3
- Some of the Time = 4, 5, 6
- Most of the Time = 7, 8
- All of the Time = 9, 10

The response functions were:

- Hiring = Identifying and acquiring personnel to fill jobs in your organization
- ES&H = The environmental, safety, and health process
- Short handed = Performing the work that would be done by a subordinate if there were enough people in your "group"
- Presentation = Giving presentations to visitors or review teams
- Admin = Administrative and reporting tasks
- Funding = Funding and budget issues

- Travel
- Justifying = Justifying your task or program
- Tech = Doing technical work
- Mng & Dir = Managing and directing the work of others
- Review = Reviewing and critiquing the work of others

No group or site has an average value of 7.0 or above to indicate "Most of the time" being spent in any one category (Table A-18). With the exception of Army, there appears to be a balance in amount of time routinely spent on tasks. Administrative and reporting tasks, managing and directing the work of others, and reviewing and critiquing the work of others are the top three functions in which DOD (OSD, JS, Agencies), Navy, and Air Force spend time. Meanwhile, doing technical work, the environmental, safety, and health process, and administrative and reporting tasks are the top three functions in which Labs, Plants, and DOE Headquarters spend time. Doing technical work is the function in which the greatest amount of time is routinely spent.

Identifying and acquiring personnel to fill jobs in the organization is the function in which the least amount of time is routinely spent by any of the groups or site except for Navy.

Table A-18. How Much Time Do You Routinely Spend…

	DOD HQ	Army	Navy	Air Force	DOE Labs	DOE Plants	DOE HQ
Hiring	3.5	3.9	4.0	3.7	2.8	2.3	2.8
ES and H	4.3	5.0	4.8	4.3	5.3	5.3	5.7
Short handed	5.5	5.9	5.5	5.8	5.0	4.6	5.3
Presentation	4.2	4.3	4.1	4.2	3.9	3.3	4.2
Admin	6.0	6.1	6.4	6.2	5.1	5.1	6.0
Funding	3.9	4.8	4.2	3.7	4.1	3.2	4.0
Travel	4.0	4.2	3.7	3.9	3.4	2.6	4.1
Justifying	4.2	4.8	4.0	4.1	4.1	3.4	4.1
Tech	5.3	5.7	5.8	5.3	6.3	6.2	6.1
Mng & Dir	5.9	5.6	6.7	6.1	4.8	4.1	4.6
Review	5.9	5.6	6.4	6.0	4.6	4.3	5.5

If You Could Change One Thing… ?

The survey asked the open ended, textual question, "If you could change one aspect of your job, or purchase or acquire one thing to make your work easier or more efficient, what would it be?" A total of 7,831 comments were provided. Table A-19 lists the categories for the responses to this question

Table A-19. Categories: If you Could Change One Thing?

	Category
01	Management and Bureaucracy
02	Organizational Structure / Bureaucracy
03	Pay / Compensation
04	Benefits
05	Communication / Information
06	Tools / Technology
07	Facilities / Work Location
08	Job Satisfaction / Job Security
09	Productivity / Performance / Efficiency
10	Motivation / Morale / Teamwork
11	Training / Education
12	Promotions
13	Career Advancement / Hiring / Selection Process
14	Resources / Workload / Scheduling
15	Budget / Funding
16	Discrimination
17	General Security / Security Clearance / Safety
18	Mission / Vision
19	General
20	Miscellaneous
21	NULL Comments (e.g., N/A, nothing, no comments)

The predominant category was "workplace productivity and performance" (Table A-20 to A-22). The top five were:

- Workplace productivity and performance (19%)
- Resources and workload (16%)
- Bureaucracy and management (15%)
- Tools and technology (9%)
- Job satisfaction and job security (9%)

Table A-20. Selected Comments on the Importance of Workplace Productivity, Performance, and Efficiency

Job Satisfaction / Challenge / Interest	
■	Stream line acquisition processes so that research and development efforts can be implemented and delivered efficiently to the customer in a timely manner.
■	I would change the fact that every single detail of our Nuclear Security is interpreted by everyone in a different manner. If everyone would get on board with everyone else, things might actually make sense.
■	A better tool accountability program and more responsible technicians that take care of the tools they take with them. A better vehicles department that was faster and more efficient.
■	I would conduct policy analysis and strategic planning for U.S. nuclear policy and posture--actually use my skills in these fields to enhance U.S. national security.
■	We need to stop doing things the same way that we did 50 years ago. Things have changed, but current leadership has not evolved their thinking and operating ways.
■	I am close to retirement and there are few employees here that understand my particular items. Those that do are not Engineers. I have asked for someone to serve as backup or someone that I can mentor to take over support of these systems when I retire.

Table 21. Selected Comments on the Importance of Improving Organizational Structure, Management and Reducing Bureaucracy

Importance of National Mission	
■	Reduce the time for contract actions so I can get more technical work accomplished instead of chasing acquisition packages.
■	Restructure to align closer to engineering section. My work is not 'important' in the current structure.
■	Develop better procedures to efficiently reduce the amount of red tape and forms necessary to get approval.
■	I would convert the entire section into civilian positions and reorganize the rank structure. The section is currently civilian/military mixed, with no clear guidelines of responsibility or supervision.
■	Reorganize, so the same folks working in a program report to the person in charge of the program.
■	Can you purchase less bureaucracy? Too idealistic for acquisitions; more skilled, creative personnel.

Table 22. Selected Comments on Resources and Workload

Importance of National Mission	
■	Manpower. The career field manning keeps shrinking but the administrative and mission expectations have not commensurately been reduced...in fact they have added innumerable weapon system modernization programs that have exhausted my manning resources...there is no surge capability left. Yet the command still expects the same mission out put with less people.
■	More of an effort to keep experience technicians, many of the technicians once their training is completed only work on the weapon system for a year or so. It seems like a huge waste of money to give these guys TS clearances and a year or more of training, to only get a year or less worth of work out of them.
■	Return missile crew force to 24 hour alert concept. Also return staff positions to my six squadrons.
■	I would change the amount of hours that security forces on flight are required to work. More than 14 hour shifts working around nuclear weapons is unsatisfactory.
■	Stability of the workers in the section. The conversion of military slots to civilian slots has helped provide continuity to the training program the unit provides. I would continue to pursue this same approach with some other services the unit provides to ensure continuity of the programs.
■	Increase competent manning to get the job done. Decrease the external factors inhibiting you from accomplishing you mission. People are not attracted to the career field are just waiting their time to crosstrain or get out. People aren't taking the pride in ownership of their job and it affects the mission.

Appendix B. Nuclear Deterrent Workplace Survey Questionnaire

1. How important to you are each of the following job related factors?											
		Not Important			Somewhat Important				Very Important		
		1	2	3	4	5	6	7	8	9	10
a.	Compensation (salary)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
b.	Benefits (e.g., insurance, vacation, sick leave, pension, and holidays)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
c.	Employment (job) security	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
d.	Physical working environment	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
e.	Stimulation from working with co-workers	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
f.	Interesting and challenging work	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
g.	Being treated with respect	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
h.	Opportunity for self improvement	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
i.	Organization's policy for recognizing and rewarding outstanding performance	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
j.	Professional reputation of the organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
k.	Quality of internal communications, i.e., how well you're kept informed	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
l.	Opportunity for acquiring increased professional prestige or peer recognition	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
m.	Opportunity for advancement and promotion within the organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
n.	The Quality of Life in the community where your job is located	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
o.	Opportunity to make a nationally important contribution	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
p.	Opportunity for changing jobs within your organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

2. How well are each of the following job related factors provided by your current organization?

		Not Available	Available But Not Used	Below Average			Average				Above Average		
				1	2	3	4	5	6	7	8	9	10
a.	Compensation (salary)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
b.	Benefits (e.g., insurance, vacation, sick leave, pension, and holidays)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
c.	Employment (job) security	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
d.	Physical working environment	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
e.	Stimulation from working with co-workers	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
f.	Interesting and challenging work	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
g.	Being treated with respect	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
h.	Opportunity for self improvement	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
i.	Organization's policy for recognizing and rewarding outstanding performance	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
j.	Professional reputation of the organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
k.	Quality of internal communications, i.e., how well you're kept informed	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
l.	Opportunity for acquiring increased professional prestige or peer recognition	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
m.	Opportunity for advancement and promotion within the organization	❍	❍	❍	❍	❍	❍	❍		❍	❍	❍	❍

n.	The Quality of Life in the community where your job is located	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
o.	Opportunity to make a nationally important contribution	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
p.	Opportunity for changing jobs within your organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

3. Overall, how do you rate your organization in providing the previously listed services, amenities, working conditions, and environment?

	Poor - Fair			Good - Average				Very Good - Excellent		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

4. If you could participate in an exchange program or sabbatical, how interested would you be in going to each of the following places?

		Of No Interest	Of A Little Interest			Of Average Interest			Above Average Interest			Very Interested
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
a.	A non-nuclear weapons related job outside of your current organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
b.	A non-nuclear weapons related job within your current organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
c.	A nuclear weapons related job in another DOE, DoD, or Intelligence organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

5. How interested are you in working for your current organization until you retire?

	Of No Interest	Of A Little Interest			Of Average Interest			Above Average Interest			Very Interested
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

6. Please indicate whether or not your organization offers the following training modes and, if you have used them, how effective you consider each one to be?

		Not Offered	Available But Not Used	Not Effective			Of Average Effectiveness				Very Effective		
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
a.	Tuition Reimbursement, Assistance Program, or Advance Degree Program	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
b.	Leadership and Management courses	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
c.	Basic on-the-job training	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
d.	Guest lectures, symposia, or conferences	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
e.	Apprenticeship programs	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
f.	Mentoring programs (either as a mentor or student)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

7. Within the past three years, how often have you used the training/formal education opportunities offered by your organization?

	Never	Once	Twice	Three times	Four times	Five times	Six times	Seven times	Eight times	Nine times	Ten or over
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

8. How effective is your organization with regard to:											
		Not Effective			Of Average Effectiveness						Very Effective
		1	2	3	4	5	6	7	8	9	10
a.	Maintaining the ability to address technical issues	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
b.	Maintaining programmatic focus and commitment to the nuclear mission	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
c.	Balancing the demands of administrative workload against the focus on program deliverables	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
d.	Clarifying and implementing policies, procedures and practices that enable accomplishment of the organization's missions	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

9. How much time do you routinely spend with the following necessary functions?											
		Never	Very Little Time		Some of the Time			Most of the Time		All of the Time	
		1	2	3	4	5	6	7	8	9	10
a.	Identifying and acquiring personnel to fill jobs in your organization	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
b.	The environmental, safety, and health process	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
c.	Performing work that would be done by a subordinate if there were enough people in your "group"	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
d.	Giving presentations to visitors or review teams	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
e.	Administrative and reporting tasks	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
f.	Funding and budget issues	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
g.	Travel	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
h.	Justifying your task or program	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
i.	Doing technical work	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
j.	Managing and directing the work of others	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
k.	Reviewing and critiquing the work of others	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

10. How strong is the skill level of new (scientific, engineering, technical) hires/employees in each of the following areas?

		Very Weak Skills		Weak Skills		Neither Weak nor Strong Skills			Strong Skills		Very Strong Skills	
		0	1	2	3	4	5	6	7	8	9	10
a.	Writing skill	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
b.	Organizational skill	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
c.	Basic communications skill	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
d.	Leadership skill	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
e.	Problem solving skill	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
f.	Computer skill	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
g.	Technical competence and skill	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
h.	Ability to work as part of a team	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

11. Overall, how effective is your organization in attracting new hires with needed skills and experience?

	Not Effective			Of Average Effectiveness				Very Effective		
	1	2	3	4	5	6	7	8	9	10
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

12. How do you rate the career stability offered by the nuclear deterrence related work?

	Not Stable		Slightly Stable		Somewhat Stable			Mostly Stable		Completely Stable	
	0	1	2	3	4	5	6	7	8	9	10
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

13. Do you intend to perform nuclear deterrence related work until you retire?

	Yes	No
	❍	❍

14. Is there someone else in your organization (other than your boss or someone currently, similarly employed) who could perform your work if you took an extended leave?

	Yes	No
	❍	❍

15. To what extent does your current position allow you to use and maintain your technical capabilities and skills?

	Never	Very Little Time			Some of the Time			Most of the Time			All of the Time
	0	1	2	3	4	5	6	7	8	9	10
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

16. Would you recommend your organization as a good place to work?

	Yes	No
	❍	❍

17. For how many years have you been involved with nuclear deterrence related work?

	< 1 yr.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	> 32
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

18. How much of your time do you currently spend working on nuclear deterrence matters versus non-nuclear-deterrence-related tasks?

	Never	Very Little Time			Some of the Time			Most of the Time			All of the Time
	0	1	2	3	4	5	6	7	8	9	10
	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

19. What is your highest level of education?

	High School	Associates Degree	Bachelor's Degree	Masters Degree	PhD	Post-Doc
	❍	❍	❍	❍	❍	❍

Indicate all those that apply to you, your current position, and your skills.

20. For Department of Defense, your location:		
	❑	OSD Policy
	❑	OSD Acquisition
	❑	Navy Operations/Training
	❑	Navy Acquisition
	❑	US Air Force Operations/Training
	❑	US Air Force Acquisition
	❑	US Army Operations/Training
	❑	US Army Acquisition
	❑	Joint Staff
	❑	DTRA
	❑	DIA
	❑	Other Intel
	❑	STRATCOM
	❑	Other Combatant Commands
	❑	Other (specify)
	❑	I am not Department of Defense

21. For Department of Energy, your location:		
	❑	DoE / NNSA Headquarters
	❑	NNSA Site Offices / Service Center
	❑	Sandia National Labs, CA
	❑	Sandia National Labs, NM
	❑	Lawrence Livermore National Labs
	❑	Los Alamos National Labs
	❑	Nevada Test Site
	❑	PANTEX
	❑	Savannah River Site
	❑	Oak Ridge/Y-12
	❑	Kansas City Plant
	❑	DoE Other (specify)
	❑	I am not Department of Energy

22. Your Area of Employment: Mark all that apply		
	❑	Policy
	❑	Science and Technology
	❑	Intelligence and Threat
	❑	Acquisition
	❑	Deployment (including security) Assessment

	❑	Design, Engineering and Research Development
	❑	Operational Training
	❑	Military Operations
	❑	Other (specify)

23. You are: Mark all that apply		
	❑	Military
	❑	Federal Employee
	❑	Civilian Contractor
	❑	Consultant (not a retiree)
	❑	Military retiree rehire as a consultant or contractor
	❑	Other (specify)

24. Your Role: Mark all that apply		
	❑	Scientist
	❑	Engineer
	❑	Technician
	❑	Operator
	❑	Maintainer
	❑	Trainer
	❑	Security
	❑	Policy
	❑	Analyst

25. What is your age?

26. What initially attracted you to your organization and nuclear deterrence work?

27. If you could change one aspect of your job, or purchase or acquire one thing to make your work easier or more efficient, what would it be?

28. If this task force could pass on your comments directly to the senior leadership of the Department of Defense and Department of Energy, what would you tell them?

THE UNDER SECRETARY OF DEFENSE

3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Terms of Reference -- Defense Science Board (DSB) Task Force on Nuclear Deterrence Skills

Building on the Chiles Commission report, the Department of Energy's (DoE's) critical skills program, and the recent DSB reports on strategic forces skills, you are requested to form a DSB Task Force to:

1. Assess all aspects of nuclear deterrent skills (military, federal, and contractors). Use the 2000 Nuclear Posture Review and the Strategic Capabilities Assessment to frame the operating environment of this assessment, which should include, but not be limited to:

a. Nuclear project management

b. Nuclear safety and security

c. Weapons effects, simulators, electromagnetic pulse, and survivability (both on a DoD-wide and DTRA-specific assessment)

d. Design and logistics

e. C2, nuclear operations (crew training), and execution

f. Planning (intelligence and targeting)

g. Nuclear policy

2. Assess the progress DoE has made since the publication of the Chiles Commission report, particularly in light of the laboratory competition on the Reliable Replacement Warhead.

3. Recommend methods and strategies to maintain a right-sized, properly trained and experienced work force to ensure the viability of the U.S. nuclear deterrent through 2020.

The study will be co-sponsored by me and the Acting Assistant to the Secretary of Defense (Nuclear and Chemical and Biological Programs). Admiral (Ret) Henry Chiles will serve as chairman of the Task Force. Mr. Dan Wilmoth, OATSD(NCB), will serve as Executive Secretary, and Commander Cliff Phillips, USN, will serve as the DSB Secretariat representative.

The Task Force will operate in accordance with the provisions of Public Law 92-463, "Federal Advisory Committee Act," and DoD Directive 5105.4, "DoD Federal Advisory Committee Management Program." It is not anticipated that this Task Force will need to go into any "particular matters" within the meaning of section 208 of title 18, U.S. Code, nor will it cause any member to be placed in the position of acting as a procurement official.

Kenneth J. Krieg

OCT 16 2008

Task Force Membership

CHAIRMAN

Name	Affiliation
ADM Henry Chiles, USN (Ret.)	Private Consultant

MEMBERS

Dr. Robert Barker	Private Consultant
GEN Michael Carns, USAF (Ret.)	Private Consultant
Dr. John Foster, Jr.	Private Consultant
Dr. David Graham	Institute for Defense Analyses
Dr. William Graham	Private Consultant
GEN Al Gray, USMC (Ret.)	The Potomac Institute for Policy Studies
Mr. Steven Guidice	Private Consultant
Dr. Miriam John	Sandia National Laboratories
Dr. Robert Strickler	Private Consultant
GEN John Tilelli, USA (Ret.)	Private Consultant
Dr. Richard Wagner	Los Alamos National Laboratory
GEN Larry Welch, USAF (Ret.)	Institute for Defense Analyses
Dr. Mike Wheeler	Defense Threat Reduction Agency
Mr. Ed Wright	Systems Planning & Analysis

GOVERNMENT ADVISORS

Dr. Beverly J. Berger	NNSA

EXECUTIVE SECRETARY

Mr. Dan Wilmoth	OATSD(NDB)/NM

DSB REPRESENTATIVE

CDR Clifton Phillips, USN	OUSD (AT&L)

STAFF

Ms. Barbara Bicksler	Strategic Analysis, Inc.
Amy Cauffman	Strategic Analysis, Inc.
Ms. Kelly Frere	Strategic Analysis, Inc.
Mr. Anthony Johnson	Strategic Analysis, Inc.
Ms. Carla King	Strategic Analysis, Inc.
Dr. Philippe Loustaunau	Private Consultant
Diane O'Neill	Strategic Analysis, Inc.

Presentations and Site Visits

Name	Topic
DECEMBER 11, 2006	
Ms. Judy Kim Office of the General Counsel	DOD Standards of Conduct
Mr. Steve Henry Deputy Assistant to the Secretary of Defense for Nuclear Matters	Nuclear Expertise
Ambassador Linton Brooks Administrator, National Nuclear Security Administration	Discussion
FEBRUARY 1–2, 2007	
Mr. Brian Green Deputy Assistant Secretary of Defense for Forces Policy	The Evolution of OSD Nuclear Policy Organizations: 1991–2007
Col Dave Sutton Joint Staff J5	Joint Staff Nuclear Deterrence Skills
Dr. George P. Nanos Associate Director, R&D Enterprise, Defense Threat Reduction Agency	DTRA Response to DSB Task Force Questions
General James E. Cartwright Commander, U.S. Strategic Command	Discussion
FEBRUARY 12, 2007	
Jim Fiore Deputy Assistant Secretary for Human Capital and Business Services, Environmental Management, NNSA	Discussion
The Honorable Ray Orbach Under Secretary for Science and Director, Office of Science, NNSA	Nuclear Science Skills in the DOE Laboratories
Ray Greenberg Director, Office of Human Resources, NNSA	NNSA Workforce Planning
Dr. David Crandall Director, Associate Deputy Administrator for Research, Development and Simulation, Office of Defense Programs, NNSA	NNSA Defense Programs Approach to Monitoring Nuclear Deterrent Capability
Steve Black Chief Operating Officer Nuclear Nonproliferation, NNSA	NNSA Critical Skills for Defense

FEBRUARY 22–23, 2007

Bob Krum SSP Shipboard Systems SES-SP201-23	SSP Overview/Civilian Personnel
Dr. William LaPlante, Jr. Johns Hopkins University Applied Physics Laboratory	System Analysis
Mr. Richard Hamly Northrop-Grumman	Underwater Launch Systems
Lisa Finneran, Program Director Bill Evans, Senior Manager General Dynamics Advanced Information Systems	Shipboard Systems
CAPT Steve Lewia SSP Missile Branch Head-SP27	Military Skills Management for Strategic Systems Programs, Submarine Launched Ballistic Missile
John Stillwell Vice President Strategic Systems Charles Stark Draper Laboratory	Draper Human Capital Management Discussiomn
Scott Marston Aliant Technosystems, Inc.	Strategic Missile Systems
Leo Sipich Technical Director, Strategic Missile Programs, Lockheed Martin	Lockheed Martin Missile Systems

MARCH 13–14, 2007

Dave Conway National Counterterrorism Center	Threat Environment
Vann Van Diepen Office of the Director, National Intelligence	Threat Environment
Sue Cottrol Defense Intelligence Agency	Nuclear Skills
Wess Carr National Security Agency	Nuclear Skills
Fran Fico The National Geospatial-Intelligence Agency	Nuclear Skills
COL Mike Peel OSD, Nuclear Matters	Nuclear Weapons Council/COP Overview
Mr. Peter Terrill OSD, Nuclear Matters	Nuclear Stockpile
Mr. David Dwyer OSD, Program Analysis and Evaluation	Nuclear Systems
COL Brian Groft, USA and Mr. Rob Biemler USANCA (FA-52s)	Army Functional Area 52 Nuclear and Counterproliferation

MARCH 28–29, 2007

Lt. Col Stephen Hamilton Air Force Space Command	Headquarters Air Force Space Command
Mr. Frank Carrillo	Air Force Safety Center
Col Henry Andrews Jr.	Air Force Nuclear Weapons Center
Lt. Col Kris Rongone AFNWCA/CC	Air Force Nuclear Weapons and Counterproliferation Agency
Col Ed "Doc" Parks AF/A3SN	Headquarters U.S. Air Force
Col M. David Lee	Headquarters Air Combat Command

APRIL 5–6, 2007

Col. Parks and Lt. Col Mowles	Air Force Nuclear Weapon Roadmap
Ms. Mary Lacey Director, National Security Personnel System	National Security Personnel System
Dr. Laura Junior Office of the Under Secretary of Defense for Personnel and Readiness	Defense Readiness Reporting System, Ready for What?
Mr. Martin Gorman	Under Secretary of Defense for Intelligence
Dr. Richard Singer and Dr. Chuck Byvik DDR&E/RHOC	Radiation Hardened Oversight Council
Honorable Ryan Henry and Mr. Dave Stein Office of the Under Secretary of Defense for Policy	From the Civil War to the Long War
Mr. Greg Hulcher Director, Portfolio Systems Acquisition	Acquisition, Technology, and Logistics
Mr. David Stein	New Triad Study

APRIL 26–27, 2007

Mr. Andrew Leipman National Counterterrorism Center	National Counterterrorism Center
Mr. Carl Dever Northrop-Grumman	B-2 Bomber and Integrated Systems
Dr. Beverly Berger NNSA	NNSA
COL John Mercier Director, Military Medical Operations, AFRRI	Armed Forces Radiobiology Research Institute (AFRRI) and Med Corps
COL Barrett Lowe 20th Support Command (CBRNE)	Capabilities Brief and Way Ahead
Mr. Randy Davis	Redbook Program Support to DOD Missions

MAY 14–15, 2007

Mr. John Clay Northrop-Grumman	Nuclear Deterrent Skills: ICBM Perspective
Mr. Tony Gulley Boeing	Nuclear Deterrent Expertise: Boeing Perspective
Mr. Tom Gennaro Lockheed Martin	Nuclear Deterrent Critical Skills and Sustainment Strategies
Mr. Charles Abernethy Aerojet	Health of the Nuclear Strike Industrial Base
Mr. David Buhaly and Mr. Scott Marston ATK	ATK Launch Systems
Mr. Rick Fuit ICBM SPO	526 ICBM Systems Wing
Ms. Susan Parker and Mr. Howard Schue Technology Strategies and Alliances	Maintaining Advantage in a Multi-Polar Nuclear World

MAY 30–31, 2007

Dr. George Ulrich	SAIC
Mr. William Smith	URS
Mr. Bryan Gabbard Defense Group	Assuring Future DOD Nuclear Capabilities
Mr. Rob Sues	ARA
Dr. Keith Paymne	NIPP
Mr. Gary Mahle	ITT
CAPT George Hoffer	Office of the Assistant Secretary of Defense for Networks and Information Integration
Mr. Wesley Carr	National Security Agency
Ms. Charlotte Dawson	Defense Information Systems Agency
Mr. Joe Gershon	U.S. Strategic Command
Dr. John Weinstein NSS	NC2 Personnel Expertise: An NSS Perspective
Mr. Clark Murdock	Center for Strategic and International Studies

JUNE 12–14, 2007

Site Visits to:
Air Force Nuclear Weapons Counter-proliferation Agency
Air Force Nuclear Weapons Center
Air Force Safety Center
NNSA Service Center
Los Alamos National Laboratory Site Office
Sandia National Laboratory/New Mexico
DTRA School House

JULY 9–10, 2007

Site Visit to U.S. Strategic Command

JULY 19–20, 2007

Site Visits to:
Air Force Space Command
526th ICBM Systems Wing

SEPTEMBER 5–6, 2007

Site Visits to:
20th Air Force
Kansas City Plant

SEPTEMBER 19–20, 2007

Site Visit to Minot Air Force Base - 91st SW

OCTOBER 10–12, 2007

Site Visits to:
Barksdale 8th Air Force
Pantex

OCTOBER 21–23, 2007

Site Visits to:
Y-12
NNSA Headquarters
Defense Threat Reduction Agency

NOVEMBER 27–29, 2007

Site Visits to:
Group 9 Bangor
Los Alamos National Laboratory
Los Alamos National Laboratory SO
Sandia National Laboratory, California

DECEMBER 18–19, 2007

Mr. Bill Daitch	DNDO/National Nuclear Forensics Expertise
Dr. A. J. Eggenberger, Chairman	DNFSB/Technical Capability in the NNSA Nuclear Weapons Complex
Mr. Phillip Hookham Vice President Weapons Effects Dept. L-3 Communications	L-3 Communications Nuclear Skills Overview
Mr. Jim Howard	SSP Update
Mr. Greg Hulcher and Mr. Dennis Evans OSD, Program Analysis and Evaluation	New Triad Update
Dr. Billy Mullins	Air Force Perspective on the Nuclear Deterrent Mission
Dr. Billy Mullins	Minot Incident
Dr. Theodore Hardebeck	Findings of the STRATCOM Nuclear Skills Study

JANUARY 17–18, 2008

Site Visits to: Whiteman Air Force Base 509th BW National Test Site

FEBRUARY 19–20, 2008

Mr. Bob McKay NNSA (SS-21)	Seamless Safety for the 21st Century
Dennis Evans and Greg Hulcher OSD Program Analysis and Evaluation	New Triad Funding

MARCH 10–12, 2008

John Welsh, Robert Morrison, and Bob Krum SSP	Tracking Operational Deficiencies
Gen Robert Smolen	Vision for NA10

MARCH 26–27, 2008

LTC Nicholas Prins Department of Homeland Security	Domestic Nuclear Detection Office
Mr. Larry Trumbull	JAIC
Dr. John Weinstein NSS	Nuclear Command and Control: System Comprehensive Review
Anna Chandonnet Data Recognition Corporation	Survey Results

APRIL 2–3, 2008

Alexander Goodale Deputy Director for Intelligence, Department of Energy	The Role of the DOE Office of Intelligence in Matters Nuclear
Mr. Steve Black Chief Operation Officer, Defense Nuclear Nonproliferation, NNSA	NA-20
Mr. Mike Evenson Defense Threat Reduction Agency	Nuclear Weapon Effect Response
General Chilton Commander, U.S. Strategic Command	Nuclear Matters at U.S. Strategic Command

Glossary

AFRRI	Armed Forces Radiation and Radiobiology Institute
ALCM	air-launched cruise missle
CI	critical infrastructure
C3ISR	command, control, communications, intelligence, surveillance, and reconnaissance
CTBT	Comprehensive Test Ban Treaty
CTM	Conventional Trident Modification
DARPA	Defense Advance Research Projects Agency
DHS	Department of Homeland Security
DIA	Defense Intelligence Agency
DNDO	Domestic Nuclear Detection Office (at DHS)
DOD	Department of Defense
DOE	Department of Energy
DOE (DP)	Department of Energy (Defense Programs)
DSB	Defense Science Board
DTRA	Defense Threat Reduction Agency
EMP	electromagnetic pulse
FTB	fire control technician
GIG	Global Information Grid
GPF	general purpose forces
IC	Intelligence Community
ICBM	intercontinental ballistic missle
ISR	intelligence, surveillance, and reconnaissance
JCS	Joint Chiefs of Staff
JITF-CT	Joint Intelligence Task Force for Combating Terrorism
JS	Joint Staff
KCP	Kansas City plant
LEP	life extension program
LANL	Los Alamos National Laboratories
LLNL	Lawrence Livermore National Laboratories
MMI, MMII, MMIII	Minuteman I, III, III

NCC	nuclear command & control
NCTC	National Counterterrorism Center
NGA	National Geospatial-Intelligence Agency
NIC	National Intelligence Council
NN-20	Office of Nonproliferation Research and Engineering (at NNSA)
NNSA	National Nuclear Security Administration
NPR	Nuclear Posture Review
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
OSD	Office of the Secretary of Defense
PRP	Personnel Reliability Program
QDR	Quadrennial Defense Review
RRW	Reliable Replacement Warhead
SECDEF	Secretary of Defense
SLBM	submarine-launched ballistic missle
SRS	Savannah River Site
SSBN	ballistic missile submarine
SSP	Stockpile Stewardship Program
SSP	Strategic Systems Program (Navy)
S&T	science and technology
STRATCOM	U.S. Strategic Command
SWFPAC	Special Weapons Facility, Pacific
TLAM-N	Tomahawk Land Attack Missile- Nuclear
TRAC	Threat Reduction Advisory Committee
USAF	United States Air Force
USANCA	U.S. Army Nuclear & Chemical Agency
USD (A&T)	Under Secretary of Defense for Acquisition & Technology
USD (AT&L)	Under Secretary of Defense for Acquisition, Technology & Logistics
USD (I)	Under Secretary of Defense for Intelligence
USMC	United States Marine Corps
USN	United States Navy
WMD	weapons of mass destruction